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ANNUAL AIR QUALITY
DATA SUMMARY
FOR
MONTANA

1976

THE MONTANA DEPARTMENT OF HEALTH
AND ENVIRONMENTAL SCIENCES
ENVIRONMENTAL SCIENCES DIVISION
AIR QUALITY BUREAU
HELENA, MONTANA

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I. INTRODUCTION

This report is the second annual air quality data summary published by the Montana Department of Health and Environmental Sciences (DHES). The data presented consists of that data gathered in air quality monitoring in the five Air Quality Control Regions for 1976. This report is divided into two main sections. Section II and the main body of the report is orientated toward the general public who wishes an overall report on the air quality of Montana for 1976. The pollutants addressed in this section are sulfur dioxide and total suspended particulates. Section III is orientated toward individual special studies performed throughout the state. This section summarizes all air pollutants measured in each study area.

Appendix A summarizes the federal and Montana ambient air quality standards.

Appendix B lists the staff involved in the air quality studies.

The data collected in this report consist of that data gathered by monitoring activities of the Air Quality Bureau of the Montana Department of Health and Environmental Sciences; the Cascade County Air Pollution Control; the Missoula City-County Health Department; and the Yellowstone County Air Pollution Control.

The map in Figure 1 illustrates the five Air Quality Control Regions (AQCR) for Montana. The data in Section II of this report discusses the results of monitoring by AQCR.

Figure 1

Montana Air Quality Control Regions



II. GENERAL AIR QUALITY

A. Billings Air Quality Control Region - Region 140

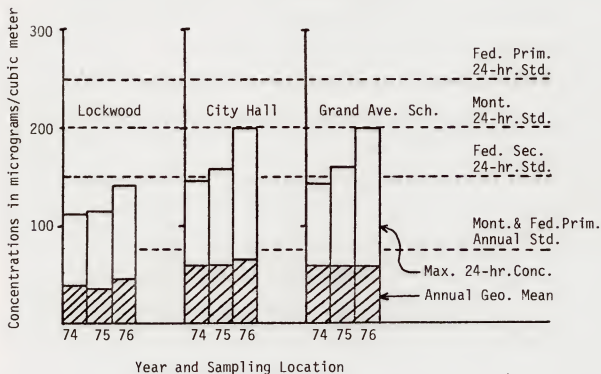
The annual arithmetic mean for total suspended particulates for all stations in Region 140 during 1976 was 57.6 micrograms/cubic meter. The region contains 11 counties and many of the counties are very sparsely populated. Therefore, the levels of particulates vary largely, with the Billings metropolitan area having the highest averages. The Region 140 has a population of 135, 243 with 56 percent of these located in the Billings-Laurel metropolitan area. The maximum annual geometric average* recorded in the Billings area was 63.8 micrograms/cubic meter and the highest 24-hour level measured was 200 micrograms/cubic meter. Sulfur dioxide for the region was measured only in the Billings metropolitan area. Measurements showed arithmetic average concentration of approximately 0.03 parts per million. Table 2 summarizes sulfur dioxide and particulate data for selected sites in the region. Both the federal and Montana ambient air quality standards for sulfur dioxide were exceeded during 1976 and the federal secondary standard for particulates was exceeded. Figure 2 shows graphically the trend of the particulate levels in the Billings area. The trend indicates little change in the average concentrations but the maximum 24-hour reading for each year appears to be increasing.

Primary industries in this region are cattle ranching, farming, oil and gas production, coal mining, and petroleum refining and transportation. Two sawmills are located in this region. Table 1 indicates the estimated emissions from the major sources in the region. Other than the power plant in Billings, the largest point sources are the three refineries which emit large quantities of particulates, sulfur dioxide, nitrogen dioxide, and hydrocarbons.

*Geometric average given here to compare with ambient air quality standards. (Appendix A)

Table 1 also shows the estimated emissions from the major area sources in the region. In AQCR 140 the largest area source of particulates is unpaved roads with agriculture ranking as the second highest emitter.

FIGURE 2
Trend of Total Suspended Particulate Concentrations
Measured in the Billings Area



Billings Air Quality Control Region - Region 140
Major Sources Estimated Emissions - 1976

Sources	Estimated Emissions (Tons Per Year)	
	Sulfur Dioxide	Particulates
Point Sources		
Cenex		
Laurel	11,830	398
Conoco		
Billings	2,584	263
Exxon		
Billings	9,800	932
Great Western Sugar Co.		
Billings	815	65
Montana Power Company		
Billings	12,733	1,726
Montana Sulphur & Chemical Co.		
Billings	2,000	Neg.
US Gypsum		
Lewistown	Neg.	73
Westmoreland		
Hardin	unknown	19
Area Sources*		
Unpaved Roads	---	141,786
Agriculture	---	5,839
Open Burning	---	1,125
Other	2,007	3,662

* Only the counties of Yellowstone, Carbon, Stillwater, Sweetgrass and Big Horn

TABLE 2

Billings Air Quality Control Region - Region 140
Selected Stations Ambient Air Quality Data - 1976

Site	Sulfur Dioxide (Parts Per Million)		Particulates (Micrograms Per Cubic Meter)	
	Max. 24-Hour	Arith. Aver.	Max. 24-Hour	Geo. Aver.*
Lockwood School	0.04	0.033	141.0	45.1
City Hall	---	---	200.0	63.8
Grand Ave. School	---	---	199.0	58.0
Montana & N. 27th	0.04	0.008	---	---
Farm E. Cenex	0.38	0.061	---	---

*Geometric Average

B. Great Falls Air Quality Control Region - Region 141

The annual arithmetic average of total suspended particulates for Region 141 during 1976 was 64.7 micrograms/cubic meter. This region contains 9 counties and one major metropolitan area with much of the region remaining sparsely populated. The Region 141 had a 1970 census of 144,070 with 49 percent of these residing in the metropolitan area of Great Falls. In the Great Falls area, the maximum annual geometric average recorded was 74.2 micrograms/cubic meter and the maximum 24-hour measurement recorded was 202 micrograms/cubic meter. Only two particulate monitors were operated in the region, therefore, leaving large areas as having unknown particulate levels. Sulfur dioxide was not measured in the Great Falls region during 1976. Table 4 summarizes particulate data for selected sites in the region. The federal primary ambient particulate standard was not exceeded during 1976 and the Montana ambient particulate standard was exceeded one time. Figure 3 shows graphically the trend of the particulate levels at the two longest operating stations in the Great Falls area. The graph shows that generally over the last three years particulate concentrations have decreased.

Primary industries in this region are cattle ranching, wheat farming, and oil and gas activities in the northwestern and northeastern areas of the region. A small petroleum refinery is located at Cut Bank. Two large grain processing plants are located at Great Falls. The only other major source of sulfur dioxide in the region is the refinery at Great Falls. These four plants are listed in Table 3 with estimated emissions. Also shown in Table 3 are the area source emissions for the AQCR.

FIGURE 3

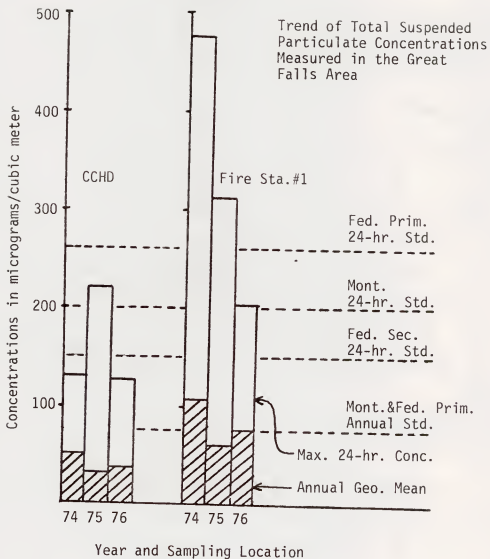


TABLE 3

Great Falls Air Quality Control Region - Region 141
Major Sources Estimated Emissions - 1976

Sources	Estimated Emissions (Tons Per Year)	
	Sulfur Dioxide	Particulates
<u>Point Sources</u>		
Con-Agra Great Falls	0	70
General Mills Great Falls	0	32
Phillips Petroleum Great Falls	1,807	72
Westco Refining Cut Bank	883	11
<u>Area Sources</u>	2,600	251,000

TABLE 4

Great Falls Air Quality Control Region - Region 141
Selected Stations Ambient Air Quality Data - 1976

Site	Sulfur Dioxide (Parts Per Million)		Particulates (Micrograms Per Cubic Meter)	
	Max. 24-Hour	Arith. Aver.	Max. 24-Hour	Geo. Aver.
Cascade Co. Health Dept.	---	---	124	36.2
Fire Station #1	---	---	202	74.2

The arithmetic average of total suspended particulates for Region 142 during 1975 was 53.1 micrograms/cubic meter. The region contains 12 counties and several metropolitan areas. The region had a 1970 census of 167,100. The three major metropolitan areas where significant monitoring was conducted are Helena, Butte and Anaconda. The area of highest particulate levels was Butte with one station having a geometric average of 92.5 micrograms/cubic meter with a maximum 24-hour level of 306 micrograms/cubic meter. Due to the location of two large sources of sulfur dioxide in the region, the measurements for sulfur dioxide were orientated toward these sources and are not representative of the entire region. The Helena area monitors had an annual average sulfur dioxide concentration of 0.008 parts per million. The maximum 24-hour reading was 0.14 parts per million. In the Anaconda area, the annual average of sulfur dioxide monitors was 0.015 parts per million. The maximum 24-hour reading was 0.60 parts per million. The ambient particulate standards were violated on many occasions in the Butte area and on less occasions elsewhere in the region. The federal and Montana ambient sulfur dioxide standards were violated at several locations in the Helena and Anaconda areas. Table 6 summarizes sulfur dioxide and particulate data for selected sites in the region. Figure 4 shows graphically the trend of particulate levels at three of the longest operating stations in the Helena AQCR. The results differ with each area sampled. The greatest reduction has been at the McKinley Res. site at Philipsburg. Concentrations have increased at the Butte station.

Figure 5 shows graphically the trend of sulfur dioxide levels at three of the longest running sites in East Helena and Anaconda. The Anaconda site shows generally increasing levels of sulfur dioxide while the East Helena sites show a varied trend with no obvious pattern.

The majority of the point sources of air pollution in Region 142 are wood processing operations including some 14 sawmills with tepee burners. Emissions from these sources include mainly particulates, hydrocarbons and carbon monoxide. The two largest pollution sources in the region, however, are a lead smelter and a copper smelter. Emissions from these sources dominate the sulfur dioxide levels in the Helena and Anaconda areas. These sources emit large quantities of carbon monoxide, sulfur dioxide and particulates. Another large pollution source in this region is the Berkeley open pit mine. The major emissions from the mine are particulates, hydrocarbons and oxides of nitrogen.

The region also contains one elemental phosphorous plant. This source releases mainly fluoride, particulates and sulfur dioxide into the air. Two cement plants and two talc plants are also located in the region. These plants emit mainly particulates and oxides of nitrogen. The region also contains many smaller air pollution sources which contribute to the overall pollution level. These include hot mix plants, incinerators, agricultural burning, motor vehicles and unpaved roads. Table 5 lists the estimated emissions from these and other sources in the region.

TABLE 5

Helena Air Quality Control Region - Region 142
Major Sources Estimated Emissions - 1976

Sources	Estimated Emissions (Tons per year)	
	Sulfur Dioxide	Particulates
<u>Point Sources</u>		
American Smelting & Refining Co.		
East Helena	80,000	415
Anaconda Company		
Anaconda	321,136	10,306
Kaiser Cement		
Montana City	---*	204
Ideal Cement		
Trident	---*	263
Pfizer		
Dillon	5	124
Berkeley Open Pit Mine		
Butte	207	6,080
Stauffer Chemical Co.		
Silverbow	208	73
U.S. Plywood		
Silver City	1	13
Townsend Lumber		
Townsend	1	20
Yellowstone Pine		
Belgrade	1	15
Elk Studs		
West Yellowstone	1	12
Burkland Studs		
Livingston	1	12
<u>Area Sources +</u>		
Unpaved Roads	---	81,278
Agriculture	---	101
Open Burning	---	7,047
Other	977	2,816

* Unknown at this time.

+ Only the counties of Lewis & Clark, Deer Lodge, and Silver Bow

TABLE 6

Helena Air Quality Control Region - Region 142
Selected Stations Ambient Air Quality Data - 1976

Site	Sulfur Dioxide (Parts Per Million)		Particulates (Micrograms Per Cubic Meter)	
	Max. 24-hour	Arith. Aver.	Max. 24-hour	Geo. Aver.
212 Pacific St. E. Helena	---	---	187.0	74.9
Saddle Mtn. E. Helena	0.13	0.008	---	---
Microwave E. Helena	0.14	0.012	84.0	24.2
C-Hill Anaconda	0.37	0.016	---	---
Hi-way Jct. Anaconda	0.60	0.023	250.0	40.9
Silver Bow Gen. Hosp. Butte	---	---	173.0	53.5
Atkins Butte	---	---	306.0	45.4
McKinley Res. Granite Co.	---	---	147.0	24.2
Tierney Res. Silver Bow Co.	---	---	202.0	31.3

FIGURE 4

Trend of Total Suspended
Particulate Concentrations
Measured in the Helena AQCR

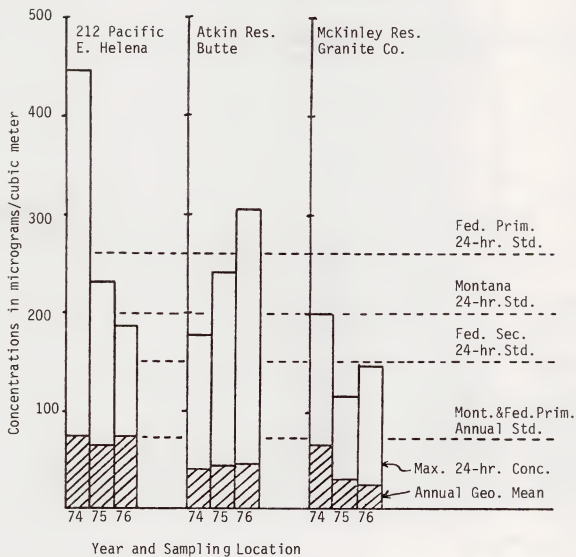
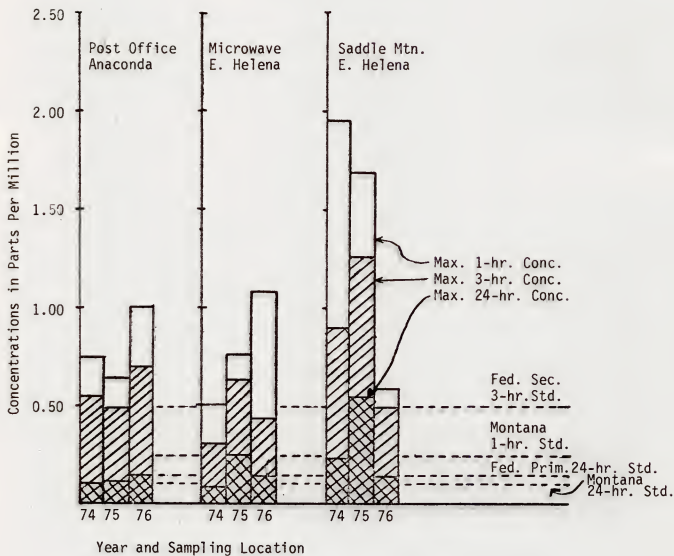


FIGURE 5

Trend of Sulfur Dioxide Measured
in the Helena AQCR



D. Miles City Air Quality Control Region - Region 143

The annual arithmetic mean for total suspended particulates for Region 143 for 1975 was 26.4 micrograms/cubic meter with a maximum 24-hour level of 166 micrograms/cubic meter. The region contains 17 counties, all of which are fairly sparsely populated. The region has a total population of 97,554. Increased activity is present in this region as it contains major coal fields. Sulfur dioxide was monitored at several locations in the region but little or no sulfur dioxide was detected. Violations of the federal and Montana ambient air quality standards for particulates were recorded on company run monitors (data not shown here). Table 8 summarizes sulfur dioxide and particulates data for selected sites in the region from state run monitors.

Primary industries in this region consist of cattle ranching, farming oil and gas production, and coal mining. Estimated emissions from the major sources in the region are listed in Table 7. The three largest emitters in the region are the three power plants presently operating. At Colstrip two 350 megawatt power plants are operating while a smaller power plant is operating at Sidney.

Miles City Air Quality Control Region - Region 143
Major Sources Estimated Emissions - 1976

Sources	Estimated Emissions (Tons Per Year)	
	Sulfur Dioxide	Particulates
<u>Point Sources</u>		
Hallett Minerals Vananda	38	59
Holly Sugar Company Sidney	226	116
Montana Power Co. Unit #1+ Colstrip	3234	329
Montana-Dakota Utilities Sidney	2560	110
Tumpane Co. Glasgow AFB	174	29
<u>Area Sources*</u>		
Unpaved Roads	----	81,170
Agriculture	----	4,068
Open Burning	----	803
Other	596	1,427

+ Only partial year of operation

* Only the counties of Rosebud, Treasure, Custer, Fallon, Powder River and Carter

TABLE 8

Miles City Air Quality Control Region - Region 143
Selected Stations Ambient Air Quality Data - 1976

Site	Sulfur Dioxide (Parts Per Million)		Particulates (Micrograms Per Cubic Meter)	
	Max. 24-hour	Arith. Aver.	Max. 24-hour	Geo. Aver.
BN Site				
Colstrip	0.0	0.0	104.0	28.3
Littlefield				
Miles City	---	---	87.0	19.0
Broadus				
Powder River Co----		---	62.0	15.6
Lindsay				
Dawson Co. ---		---	60.0	14.5
FortPeck				
MCCone Co. 0.0		0.0	166.0	21.1
Glendive				
Dawson Co. ---		---	102.0	27.4

E. Missoula Air Quality Control Region - Region 144

The annual arithmetic mean for total suspended particulates for Region 144 during 1975 was 67.9 micrograms/cubic meter. The region consists of 7 counties with a population of 154,691. The major metropolitan area is Missoula, which also recorded the highest 24-hour particulate level of 386 micrograms per cubic meter. One monitor in Columbia Falls had an annual geometric average of 97.7 micrograms/cubic meter with the maximum 24-hour level being 294 micrograms/cubic meter. High levels were also recorded in the Kalispell and Libby areas. Sulfur dioxide was not measured during 1976 in Region 144. Violations of federal and Montana ambient particulate standards were measured at several locations mainly around the urban areas. Missoula recorded the greatest number of particulate matter violations. Table 10 summarizes particulate data for selected sites in the region.

The majority of the point sources of air pollution in Region 144 are wood processing operations - some 25 sawmills with tepee burners or wood waste boilers, 5 plywood plants, 2 particleboard plants, a pulp mill, etc. Other sources include an aluminum reduction plant, vermiculite plant and several aggregate processing plants. The emissions from these sources are primarily particulate matter, but the aluminum plant emits large quantities of fluoride and the pulp mill is a significant source of various odorous sulfide compounds.

There are a number of other sources of particulate matter which individually are small but cumulatively can contribute considerably to the total particulate emissions. Included in this group are incinerators, agricultural burning, small heating plants, small manufacturing operations, motor vehicles and others. Probably the two most conspicuous of these "area" sources are forest slash burning and unpaved roads.

Table 9 summarizes emission estimates from the major point and area sources in the region.

Figure 6 shows graphically the trend of particulate levels at two sites in the Missoula area. Both sites show similar patterns with no obvious trend shown.

TABLE 9

Missoula Air Quality Control Region - Region 144
Major Sources estimated emissions - 1976

Sources	Estimated Emissions	
	Sulfur Dioxide	(Tons Per Year) Particulates
<u>Point Sources</u>		
Anaconda Aluminum		
Columbia Falls	---	1,560
Louisiana-Pacific (particleboard)		
Missoula	0	952
Evans Products (plywood)		
Missoula	4	36.5
W.R. Grace		
Libby	1,259	431
Hoerner Waldorf Division		
Missoula	910	755
Plum Creek Lumber		
Columbia Falls	435	34
St. Regis Paper		
Libby	1,849	370
U.S. Plywood		
Bonner	224	288
<u>Area Sources†</u>		
Unpaved roads	---	158,386
Agriculture	---	245
Open Burning	---	13,623
Other	3,282	3,221

* Unknown at this time

† Only for the Counties of Flathead, Lake and Missoula

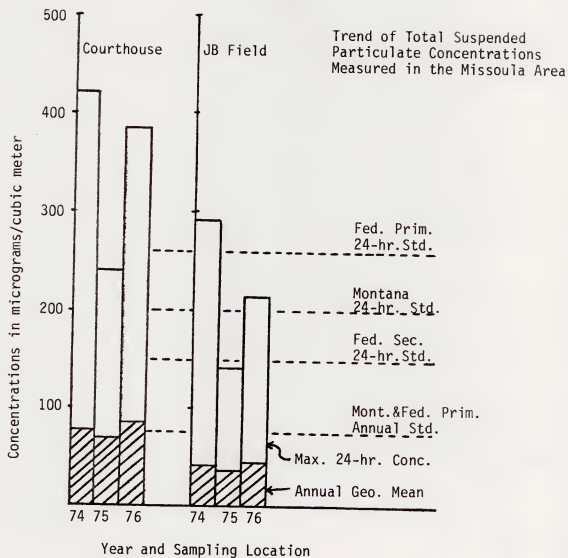
TABLE 10

Missoula Air Quality Control Region - Region 144
Selected Stations Ambient Air Quality Data - 1976

Site	Sulfur Dioxide (Parts Per Million)		Particulates (Micrograms Per Cubic Meter)	
	Max. 24-Hour	Arith. Aver.	Max. 24-Hour	Geo. Aver.
Courthouse				
Missoula	0.08*	0.032*	386.0	86.1
JB Field				
Missoula	---	---	217.0	34.6
Anders				
Columbia Falls	---	---	294.0	97.7
Sverdrup				
Libby	---	---	125.0*	48.6*

* Only partial year of data

FIGURE 6



III. SPECIAL STUDY AREA WORK

In the Billings AQCR a special study was continued in the Billings-Laurel metropolitan area. This study was conducted for both population and point-source type air pollution sources. The major sources are refineries, chemical and sugar companies and a power plant. Results of the studies indicated violations of the federal primary sulfur dioxide, the federal secondary particulate and the federal primary ozone standards. Violations of the state ambient standard for sulfation rate were also recorded.

In Great Falls AQCR a population orientated study was continued in the Great Falls metropolitan area. The Great Falls area study resulted in violations of the state standard for total dustfall and violations of the federal secondary particulate standard.

In the Helena AQCR special studies were conducted around various large point sources. In the Helena area, monitoring around the lead smelter resulted in violations of the federal secondary particulate standard. Also violations of the state sulfur dioxide standards were recorded at several locations. The state sulfation rate ambient standard was also violated. In the Anaconda area, monitoring around the copper smelter resulted in violations of the federal primary and state sulfur dioxide standards being recorded. The state sulfation rate ambient air standard was also violated. In the Butte, area monitoring was mainly conducted for emissions from the large open pit mine. Results of monitoring in this area indicated frequent violations of the federal secondary and state particulate standards. Ramsay, located a little west of Butte, was the object of ambient monitoring especially around the elemental phosphorous plant. Results of this monitoring indicated violations of the state fluoride standard on many occasions. Monitoring in the Garrison area, located north of the Butte-Anaconda area, was conducted to measure fluoride concentrations after the closing of a phosphate feed plant. Results indicated a great reduction in the fluoride concentrations.

In the Miles City AQCR, special studies were conducted for establishing background levels of pollutants in the coal development areas. Monitoring was also conducted around the two large power plants at Colstrip. Violations of the ambient air particulate standards were recorded on company run monitors. Ozone levels approached the federal primary standard on monitors operated by the state.

In the Missoula AQCR, special studies were continued in the Missoula metropolitan area and the Columbia Falls area. In the Missoula area the study was conducted for population and point-source type air pollution sources. The majority of these sources were wood products related. The results of sampling in the area indicated violations of the federal and state particulate standards. In the Columbia Falls area, monitoring was conducted around an aluminum reduction plant. Results of the sampling indicated violations of the state fluoride standard. Sampling was also conducted in various areas of western Montana around local air pollution sources. Violations of the federal and state particulate standards were recorded.

More detailed analyses of the special studies are presented in the following sections.

Billings-Laurel Area

In Region 140 a special study was continued in the metropolitan area of Billings and Laurel. This study was conducted by the Yellowstone County Air Pollution Control and the DHES. It was conducted both for population and point-source type air pollution sources. The major sources monitored were a power plant and three refineries. Table 11 summarizes the estimated emissions from the major point sources.

Air pollutants measured consisted of total suspended particulates, sulfur dioxide, sulfation rate, carbon monoxide, hydrocarbons, ozone, and nitrogen dioxide. The maps in Figures 7 and 8 illustrate the approximate locations of the major point sources and the air pollution monitors.

The results of the ambient sampling, summarized in Tables 12 through 15, indicate violations of federal secondary particulate standards, federal primary ozone and carbon monoxide standards and state and federal primary sulfur dioxide standards. Violations of the state ambient standard for sulfation rate were also recorded. The maximum particulate levels were recorded at the City Hall and Grand Avenue School sites. The City Hall site recorded a maximum 24-hour value of 200 micrograms per cubic meter (ug/m^3) and a geometric mean of 63.8 ug/m^3 . The Grand Avenue School site recorded a maximum 24-hour value of 199 ug/m^3 and a geometric mean of 58.0 ug/m^3 . Higher concentrations were recorded at the Burnstead Dr. site but this station was only operated for two months during 1976. The carbon monoxide federal 8-hour standard was exceeded at the Montana & N. 27th site. The maximum 8-hour reading was 14.63 parts per million (ppm). The federal 1-hour ozone standard also was exceeded many times at the Montana & N. 27th site. The maximum 1-hour reading was 0.10 ppm. The nitrogen dioxide standard was approached but not exceeded. The annual average at the Montana & N. 27th site was 0.03 ppm. Sulfur dioxide measurements resulted in concentrations being recorded in excess of all state and federal standards at one or more sites. The highest concentrations were recorded around the Laurel

refinery with maximum 1-hour, 3-hour and 24-hour concentrations of 0.08, 0.61 and 0.38 ppm, respectively. The Laurel Farm E. of Cenex and E. of Laurel sites recorded highest average sulfation rate values with both sites exceeding the Montana standard frequently. The sites recorded maximum values of 4.80 and 3.62 mg SO₃/100 cm²/day, respectively.

Tables 14 and 15 also show average concentrations of pollutants for 1975 and 1974 for comparison.

The Billings area is the subject of an Air Quality Maintenance Plan for the maintaining of particulate and sulfur dioxide levels within the ambient standards through 1985.

TABLE 11
BILLINGS-LAUREL AREA MAJOR SOURCES
Estimated Emissions

Point Source	SO ₂	Pollutant (Tons Per Year)				F
		Part.	NO _x	HC	CO	
Cenex	11,830	398	540	1,082	31	3
Conoco	2,584	263	1,041	1,936	53,874	3
Exxon	9,800	932	1,401	1,132	2	3
Great Western Sugar Co.	815	65	337	2	11	Neg.
Montana Power Co.	12,733	1,726	6,757	113	375	9
Montana Sulphur & Chem. Co.	2,000	Neg.	4	Neg.	Neg.	---

FIGURE 7

Billings Area

Ambient Air Monitors

Map No. Site Name

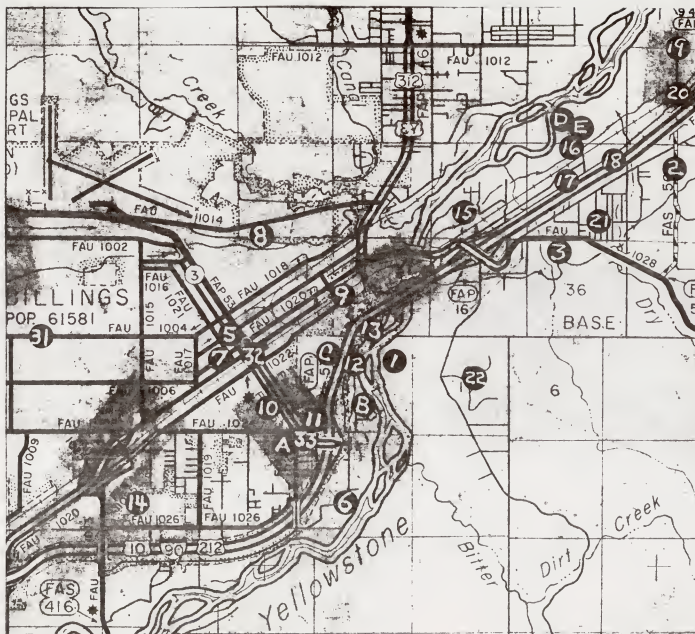
- | | |
|----|--------------------|
| 1 | Sacrifice Cliff |
| 2 | Johnson Lane |
| 3 | Lockwood School |
| 4* | KGHL Station |
| 5 | City Hall |
| 6 | Garden Avenue |
| 7 | CNR 33 & 2 Ave. N. |
| 8 | Mtn. View Blvd. |
| 9 | 1200 Minn. Ave. |
| 10 | 5th & S. 28th |
| 11 | S. 27th & 10 Ave. |
| 12 | E. Conoco |
| 13 | Two Moon Park |
| 14 | Newman School |
| 15 | Klenck Lane |
| 16 | Exxon |
| 17 | Piccolo & N Ft. Rd |
| 18 | Hi-Ball Trucking |
| 19 | Johnson & Lockwood |
| 20 | Johnson Rd. N. |
| 21 | Woodland |
| 22 | Coburn Rd. |
| 31 | Grand Ave. School |
| 32 | Montana & N. 27th |
| 33 | 11th & S. 27th |

*Not shown on map

Major Point Sources

- | Map No. | Source Name |
|---------|--------------------|
| A | Great Western Suga |
| B | Montana Power Co. |
| C | Conoco Refinery |
| D | Exxon Refinery |
| E | Mont. Sul. & Chem. |

Scale: 1 inch = 1 mile



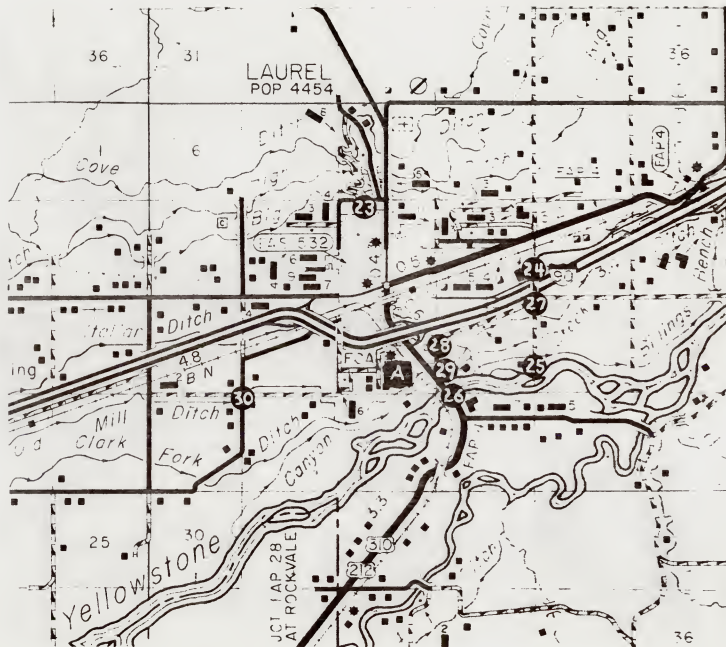


FIGURE 8

Laurel Area
(Yellowstone Co.)

Ambient Air Monitors

Map No.	Site Name
23	Laurel Jr. High
24	1 Mi. NE Coop
25	3/4 Mi. W Coop
26	1/2 Mi. S Coop
27	E. of Laurel
28	Laurel Farm
29	Water Plant
30	West Coop

Major Point Source

Map No.	Source Name
A	Cenex Refinery

Scale: 1 inch = 1 mile

TABLE 12
TOTAL SUSPENDED PARTICULATE DATA YEARLY SUMMARY YELLOWSTONE COUNTY
Jan. 1976 - Dec. 1976
Values in micrograms per cubic meter

Station*	Minimum	Frequency Distribution (% of values equal to or less than stated one)							Maximum	Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	Number of Samples Reported per Month											
		10%	30%	50%	70%	90%	95%	98%							Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Lockwood Sc.	12	24	34	43	57	104	115	133	141	52.5	30.72	45.12	1.36	51	4	5	2	5	5	6	2	5	5	5	5	2
KHGL Station	7	18	26	31	41	54	68	106	154	37.7	23.91	32.55	1.33	55	3	5	5	5	5	6	2	5	5	4	5	5
City Hall	20	39	54	66	75	95	98	199	200	69.4	32.24	63.85	1.18	53	2	5	4	4	5	6	2	5	5	5	5	5
Grand Ave Sch	5	14	60	74	90	117	125	135	199	74.1	40.95	58.03	2.05	39	4	5	1	4	4	4	2	3	3	3	2	4
Laurel Jr. Hi	6	17	26	32	45	67	73	103	108	38.3	20.64	33.53	1.33	54	5	5	5	5	5	6	2	5	5	3	5	3
Burnstead Dr	25	25	34	140	152	154	--	--	--	228.9	362.9	114.30	3.92	8	0	0	0	0	0	0	0	0	0	3	5	

* See Figures 7 and 8

TABLE 13
CONTINUOUS MONITOR DATA
Yearly Summary Yellowstone County
Values in Parts Per Million

Site	Map* No.	Pollutant	Maximum Reading				Arith.		Standards Exceeded			
			1-Hour	3-Hour	8-Hour	24-Hour	Aver.		1-Hour	3-Hour	8-Hour	24-Hour -
Laurel Water Plant	29	Sulfur Dioxide	0.50	0.32	---	0.14	0.012	14	0	---	---	3
Montana & N. 27th	32	Carbon Monoxide	27.50	21.50	14.63	---	2.363	0	---	---	5	---
		Total Hydrocarbons	10.20	8.50	---	4.52	2.690	--	---	---	---	---
		Nitrogen Dioxide	0.11	0.10	---	0.07	0.032	--	---	---	---	---
		Ozone	0.10	0.09	---	0.05	0.017	13	---	---	---	---
		Sulfur Dioxide	0.15	0.11	---	0.04	0.008	0	0	---	---	0
11th & S. 27th	33	Carbon Monoxide	9.00	6.60	4.61	---	0.511	0	---	---	0	---
		Total Hydrocarbons	8.40	7.90	---	3.74	2.405	--	---	---	---	---
Laurel Farm E. Cenex	28	Sulfur Dioxide	0.80	0.61	---	0.38	0.061	461	4	--	---	64

*See Figures 7 and 8

TABLE 14

Sulfur Dioxide Bubbler Data
Yearly Summary Yellowstone Co.
Values in parts per million

Site	Map* No.	Geometric Mean	Arithmetic Mean	Maximum 24-Hour Value	1975 A. Mean	1974 A. Mean
Lockwood School	3	0.0018	0.0223	0.2012	0.0089	---
Laurel Water Plant	26	0.0049	0.0227	0.0805	0.0108	0.0032
3/4 Mi. NE of Coop	27	0.0100	0.0259	0.1172	0.0192	0.0124
Laurel Farm E. Cenex	28	0.0105	0.0491	0.2325	0.0317	---

TABLE 15

Sulfation Rate Data Yearly Summary Yellowstone County
Values in milligrams sulfur trioxide per 100 square centimeters per day

Site	Map* No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
Sacrifice Cliff	1	1.21	0.74	7	4	0.42	0.28
Lockwood Sch.	3	1.26	0.78	8	7	0.37	0.26
Johnson Lane	2	1.05	0.57	12	7	0.28	0.24
KGHL Station	4	0.72	0.32	12	3	0.21	0.09
City Hall	5	0.42	0.16	12	0	0.16	0.04
Garden Avenue	6	0.07	0.03	12	0	0.14	0.06
CNR 33 & 2 Ave. N.	7	0.16	0.04	10	0	0.04	0.03
Mtn. View Blvd.	8	0.40	0.09	11	0	0.03	0.04
1200 Minn. Ave.	9	1.49	0.53	12	5	0.23	0.19
5th & S. 28th	10	0.45	0.10	12	0	0.07	0.10
S. 27th & 10 Ave. S1.	11	0.48	0.18	11	0	0.14	0.12
East Conoco	12	0.91	0.35	12	4	0.43	0.23
Two Moon Park	13	0.86	0.41	11	4	0.29	0.15
Newman School	14	0.63	0.18	11	1	0.12	0.05
Klenck Lane	15	1.19	0.44	8	3	0.30	0.14
Exxon	16	1.64	0.82	12	10	0.57	0.45
Piccolo & N Ft. Rd.	17	1.58	0.97	11	9	0.70	0.41
Hi-Ball Trucking	18	1.41	0.88	11	9	0.72	0.41
Johnson & Lockwood	19	2.15	0.74	12	6	0.54	0.36
Johnson Rd. N.	20	2.04	0.98	11	7	0.72	0.38
Woodland	21	1.17	0.77	12	10	0.50	0.34
Coburn Road	22	1.65	0.92	11	8	0.64	0.29
Laurel Jr. Hi.	23	0.04	0.02	12	0	0.02	0.01
1 Mi. NE Coop	24	2.02	0.83	11	6	0.47	0.32
3/4 Mi. W of Coop	25	1.25	0.58	11	6	0.38	0.37
1/2 Mi. S of Cenex	26	1.56	0.72	11	7		0.30
E. of Laurel	27	3.62	1.47	12	11	1.03	0.63
Laurel Farm E. Cenex	28	4.80	2.65	11	10	1.72	1.19
Laurel Water Plant	29	0.09	0.06	2	0	0.51	--
West Coop	30	0.91	0.23	12	2	0.23	0.08

*See Figures 7 and 8

Great Falls Area

In Region 141, a study was continued in the Great Falls area by the Cascade County Air Pollution Control. This study was conducted both for population and point-source type air pollution sources. The major industrial sources are two grain mills and a refinery. Table 16 summarizes emission estimates for these and other sources.

Sampling was performed for particulate matter (total dustfall and total suspended particulates), and sulfation rate. Results are summarized in Tables 17 through 19. The maps (Figures 9 and 10) indicate the relative location of the air monitors. The results of the sampling indicate violations of federal secondary and state total suspended particulate standards. Violations of the state standard for total dustfall were also measured. The maximum particulate levels were recorded at Fire Station #1 site with a maximum 24-hour reading of 202 micrograms per cubic meter and a geometric mean of 74.2 micrograms per cubic meter. Maximum sulfation rate values were recorded at the Phillips Refinery E site with a maximum value of 0.40 mg SO₃/100 cm²/day. The Mountain States site recorded the highest total dustfall readings with a one-month maximum of 44.0 tons/square mile.

Tables 18 and 19 also show the average concentrations of pollutants for 1975 and 1974 for comparison.

TABLE 16

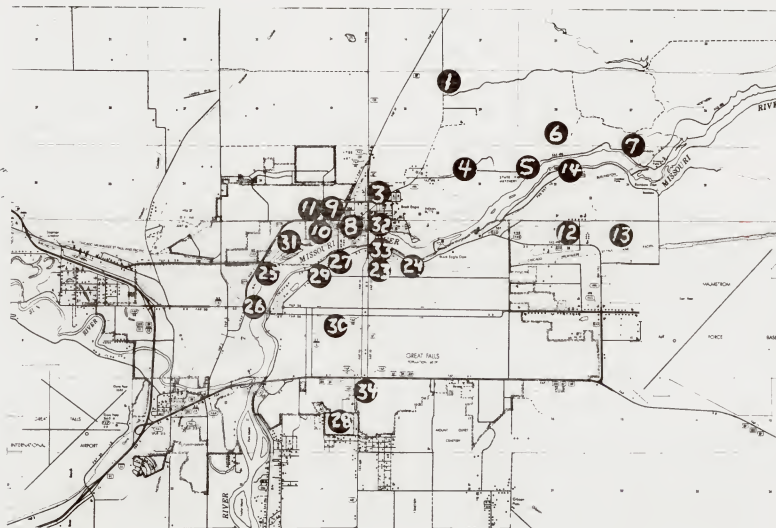
Great Falls Area Major Sources Estimated Emissions

Point Source	SO ₂	Pollutant (Tons Per Year)			
		Part.	NO _x	HC	CO
Con-Agra	0	70	Neg.	Neg.	Neg.
General Mills	0	32	Neg.	0	0
Phillips Petroleum	1807	72	142	1404	10,579

FIGURE 9

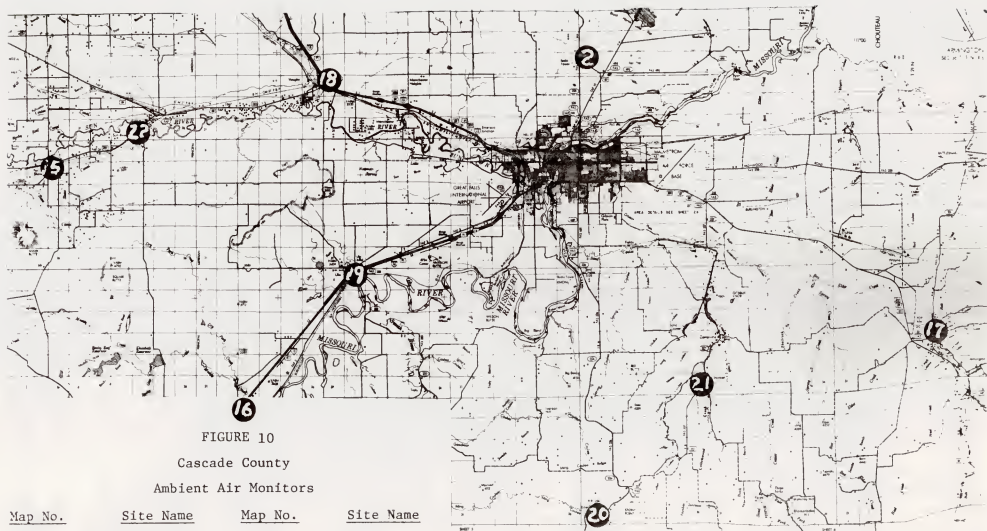
Great Falls Area

Ambient Air Monitors



Map No.	Site Name
1	ACM North
3	Stock Car Track
4	ACM East #1
5	Giant Springs
6	Mt. Power Substa.
7	Rainbow
8	Phillips Ref E
9	Phillips Ref N #1
10	Phillips Ref S
11	Phillips Ref N #2
12	Conoco W
13	Conoco E
14	River Road
23	Super America
24	Mountain States
25	Fairgrounds
26	Central West
27	J & J Cafe
28	Cascade Co. H.D.
29	City Sewage Pump
30	Fire Sta #1
31	K-Mart
32	15th St. Br. N.
33	15th St. Br. S.
34	Holiday Village

Scale: 1 inch = 1.3 miles



Scale: 1 inch = 4 miles

TABLE 17

TOTAL SUSPENDED PARTICULATE DATA YEARLY SUMMARY CASCADE COUNTY

Jan. 1976 - Dec. 1976

Station*	Minimum	Frequency Distribution (% of values equal to or less than stated one)							Maximum	Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	Number of Samples Reported per Month											
		10%	30%	50%	70%	90%	95%	98%							Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Cascade Cascade Co.	7	0	7	14	21	95	95	95	95	34.27	41.09	20.98	3.59	4	4	0	0	0	0	0	0	0	0	0	0	0
Hospital Roof Great Falls	5	13	26	41	54	79	109	116	124	44.66	28.12	36.19	1.61	95	4	4	9	8	9	9	8	9	9	8	9	9
Fire Station #1 Great Falls	10	37	60	74	101	135	173	195	202	84.98	41.99	74.21	1.37	94	4	4	9	7	8	9	9	9	9	8	9	9

*See Figures 9 and 10

Total Dustfall Data
Yearly Summary Cascade County
Values in Tons Per Square Mile

Site	Map*		Annual Aver.	No. Samples	Times Standard Exceeded	1975 Aver.	1974 Aver.
	No.	Max.					
Treasurelite Plt.	2	10.80	3.93	11	0	12.55	15.15
Giant Springs	5	24.81	11.30	12	2	10.76	16.97
Belt	17	12.51	6.87	10	0	7.57	10.40
Eden	20	35.64	7.90	12	1	5.15	9.10
Mountain States	24	44.05	22.21	11	7	26.84	24.26
Fairgrounds	25	14.92	8.70	12	0	11.56	12.22
Cascade Co. Hlth. Dept	28	18.94	7.75	12	1	7.96	7.68
Fire Station #1	30	37.73	18.86	12	8	14.05	18.45

*See Figures 9 and 10

TABLE 19
Sulfation Rate Data Yearly Summary Cascade County
Values in Milligrams Sulfur Trioxide Per 100 Square Centimeters Per Day

Site	Map*		Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
	No.	Max.					
ACM North	1	0.20	0.05	11	0	0.11	0.36
Treasurelite	2	0.11	0.03	9	0	0.04	0.25
Stock Car Track	3	0.23	0.05	10	0	0.10	0.36
ACM East #1	4	0.18	0.04	12	0	0.10	0.22
Giant Springs	5	0.11	0.04	12	0	0.07	0.16
Mt. Power Substa.	6	0.20	0.06	9	0	0.08	0.24
Rainbow	7	0.03	0.01	5	0	0.06	0.13
Phillips Ref. E.	8	0.40	0.14	10	0	0.25	0.72
Phillips Ref. N #1	9	0.33	0.13	10	0	0.29	0.87
Phillips Ref. S	10	0.26	0.08	10	0	0.18	0.24
Phillips Ref. #2	11	0.18	0.07	11	0	0.15	0.24
Conoco W	12	0.11	0.04	6	0	0.06	0.12
Conoco E	13	0.17	0.05	10	0	0.06	0.11
Fort Shaw	14	0.10	0.04	11	0	0.03	0.08
Cascade Fire Hall	15	0.10	0.06	7	0	0.07	0.09
Belt	16	0.16	0.06	10	0	0.05	0.07
Vaughn	17	0.07	0.03	10	0	0.03	0.05
Ulm	18	0.14	0.05	9	0	0.04	0.07
Eden	19	0.08	0.02	12	0	0.01	0.03
Stockett	20	0.12	0.06	6	0	0.07	0.03
Sun River	21	0.09	0.03	12	0	0.02	0.03
Super America	22	0.29	0.08	12	0	0.06	0.19
Mountain States	23	0.22	0.07	12	0	0.09	0.32
Fairgrounds	24	0.13	0.04	10	0	0.04	0.06
Central West	25	0.12	0.05	8	0	0.05	0.06
J & J Cafe	26	0.28	0.07	10	0	0.09	0.14
Casc. Co. Hlth. Dept.	27	0.08	0.04	12	0	0.02	0.16
City Sewage Pump	28	0.17	0.05	8	0	0.07	0.11
Fire Station #1	29	0.09	0.03	11	0	0.04	--
K-Mart	30	0.19	0.09	11	0	0.04	--
15th St. Br. N.	31	0.12	0.06	11	0	0.11	--
15th St. Br. S.	32	0.18	0.06	10	0	0.06	--
Holiday Village	33	0.26	0.09	12	0	0.04	--

*See Figures 9 and 10

Helena-East Helena Area

In Region 142 a special study was continued in the Helena-East Helena area jointly by the DHES and the Environmental Protection Agency. This study was orientated toward a lead smelter located near East Helena. The lead smelter is a source of sulfur dioxide, particulates and carbon monoxide (see Table 5).

Sampling was performed in the area for sulfur dioxide, particulate matter and sulfation rate (indicator of sulfur dioxide and other sulfur compounds). Tables 21 through 23 summarize the data obtained in the study. Figure 11 (refer also to Table 20) shows the location of the source and the air monitors. Violations of the federal secondary and state particulate standards were recorded. Also violations of the state sulfur dioxide standards were recorded at several locations. The state sulfation rate ambient standard was also violated. The maximum particulate levels were recorded at the 212 Pacific Street site with a maximum 24-hour value of 187 micrograms per cubic meter and a geometric mean of 74.9 micrograms per cubic meter. The maximum sulfur dioxide levels were recorded at the Microwave and Saddle Mountain sites. The maximum 24-hour readings recorded were 0.14 and 0.13 ppm, respectively. Highest average sulfation rate values were recorded at the East Station site, with a maximum value of 0.85 mg SO₃/100 cm²/day.

The lead smelter is on a program which will control both particulate matter and sulfur dioxide from the sintering operations. The smelter is putting in a 500 T/day sulfuric acid plant which will control 75% of the sulfur dioxide emissions will decrease from approximately 80,000 T/yr to approximately 370-375 T/yr due to the installation of a baghouse. The baghouse will replace the present electrostatic precipitator which was installed in 1929. The control program will be completed by July 31, 1977.

TABLE 20

Helena-East Helena Area
Ambient Air Monitors and Sources
(Key to Figure 11)

Ambient Air Monitors

<u>Map No.</u>	<u>Site Name</u>
7	Saddle Mountain
8	Microwave
10	212 Pacific St.
13	East Stack
14	Cogswell Building

Major Point Source

<u>Map No.</u>	<u>Source Name</u>
A	ASARCO, Inc.

TABLE 21

SULFATION RATE DATA
Yearly Summary Helena Area - 1976
Values in Milligrams Sulfur Trioxide per
100 Square Centimeters Per Day

<u>Site</u>	<u>Map*</u> <u>No.</u>	<u>Max.</u>	<u>Annual</u> <u>Aver.</u>	<u>No.</u> <u>Samples</u>	<u>Months</u> <u>Standard</u> <u>Exceeded</u>	<u>1975</u> <u>Aver.</u>	<u>1974</u> <u>Aver.</u>
Saddle Mtn.	7	0.48	0.23	12	0	0.24	0.27
Microwave	8	0.47	0.30	12	0	0.30	0.32
212 Pacific St.	10	0.55	0.35	12	1	0.25	0.59
East Station	13	0.85	0.69	9	9	---	--

* See Figure 11

Helena - E. Helena Area
Ambient Air Monitors and
Major Point Source

Scale: 1 inch = 1 mile

TABLE 22

TOTAL SUSPENDED PARTICULATE DATA YEARLY SUMMARY HELENA AREA

Jan. 1976 = Dec. 1976

Station*	Minimum	Frequency Distribution (% of values equal to or less than stated one)								Maximum	Arith Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	Number of Samples Reported per Month											
		10%	30%	50%	70%	90%	95%	98%	Jan.							Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Microwave	3	8	18	23	34	55	58	66	84	29.45	17.7	24.20	1.59	50	4	2	3	5	3	4	5	5	4	5	5	5	
212 Pacific St	16	40	63	78	93	124	148	176	187	83.27	36.9	74.91	1.27	56	4	3	6	4	5	4	5	5	5	5	5	5	

TABLE 23

Sulfur Dioxide Data Yearly Summary Helena Area

Values in parts per million

Site	Map* No.	Maximum Reading				Arith. Aver.	Number of Readings Exceeding			
		1-Hour	3-Hour	24-Hour			1-Hour of 0.25	3-Hour of 0.50	24-Hour of 0.10	24-Hour of 0.14
Cogswell Bldg.	14	0.38	0.32	0.08	0.002		4	0	0	0
East Stack	13	0.44	0.30	0.12	0.009		13	0	1	0
Microwave	8	1.08	0.43	0.14	0.012		73	0	1	0
Saddle Mtn.	7	0.58	0.49	0.13	0.008		31	0	2	0

*See Figure 11

Anaconda Area

A special study was continued in Region 142 in the Anaconda area jointly by the DHES and the Environmental Protection Agency. This study was oriented toward a copper smelter. The smelter is a large source of sulfur dioxide and particulates (See Table 24).

The smelter complex at Anaconda, Montana, consists of two plants, the pyrometallurgical smelter and the hydrometallurgical smelter. The two plants can produce 35 million and 6 million pounds of copper per month. However, legal agreements limit the combined output to 35 million pounds per month.

Major processes at this complex consist of four reverberatory furnaces (on stand-by) the electric furnace, eight converters, (5 on stand-by), four refining furnaces, a baghouse, an electrostatic precipitator, (on stand-by) a sulfuric acid plant, two lime kilns, and boiler house, the Arbiter plant, concentrate drying and blending area, tailings ponds and slag pile.

The smelter currently has variances for particulate emissions from foundry and from the 90% SO₂ control rule which applies to the smelter. Compliance with the SO₂ rule is related to achieving reliable operation of new smelting facilities followed by expansion of the sulfuric acid plant. Compliance with the particulate emission rule for the main stack and matte tapping hoods is questionable as of now due to interpretations of the rules. Compliance with an interim 75% control rule of sulfur dioxide will be achieved in late 1977, followed by a 6 month review of the applicable standards.

The Anaconda-Butte area is also the subject of an Air Quality Maintenance Plan for maintaining particulate and sulfur dioxide levels within the standards through 1985.

Sampling was performed in the area for sulfur dioxide, sulfation rate (indicator of sulfur compounds) and particulate matter. Tables 25, 26, and 27 summarize the data obtained in the study. Figure 12 also shows the relative locations of the source and the air monitors. Violations of the federal primary and state sulfur dioxide standards were recorded at several location. The state

sulfation rate ambient standard was also violated. The particulates sampling also resulted in a reading exceeding the federal secondary and state standard. The C-Hill, Hi-way Jct. and Mill Creek R.R. sites recorded the highest sulfur dioxide concentrations. The C-Hill site recorded a maximum 1-hour value of 2.54 ppm and a 3-hour value of 1.61. The three sites had annual arithmetic averages of 0.016, 0.023 and 0.014 ppm, respectively. The Hi-way Jct. site also recorded the highest sulfation rate concentration. This site had a one-month value of 2.57 mg SO₃/100 cm²/day and an annual average concentration of 1.01 mg SO₃/100 cm²/day.

TABLE 24

Anaconda Smelter Complex
Estimated Emissions (Tons Per Year)

Source	Part	SO ₂
Lime Kilns	97.4	neg.
Boiler Plant	7.1	Neg.
East Anaconda Crusher	17.2	None
Converter Building Roofline	1,613.0	13,500
Main Stack	8,400.0	306,200
Sulfuric Acid Plant	70.6	1,200
Electric Furnace Matte Stack	65.5	231
Electric Furnace Slag Stack	32.3	5.
Casting Wheel	3.0	None

FIGURE 12

Anaconda Area

Ambient Air Monitors

Map No.	Site Name
1	Post Office
2	Hiway Junction
3	Johnson Ranch
10	Durant Canyon
12	Pump House
13	A-Hill
14	B-Hill
15	D-Hill
16	E-Hill
17	F-Hill
18	C-Hill
20	Lost Creek
21	G-Hill
22	H-Hill

Major Point Source

Map No.	Source Name
A	Anaconda Company

Scale: 1 inch = 2 miles

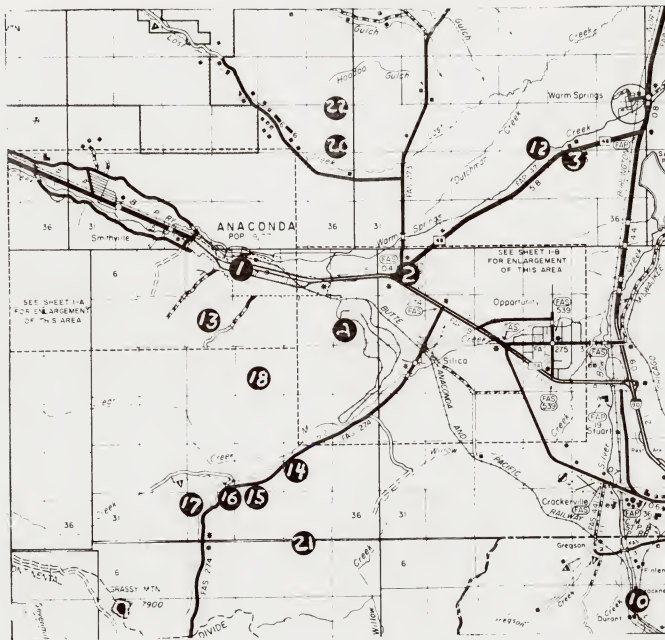


TABLE 25
Sulfur Dioxide Data
Yearly Summary Anaconda Area
Values in Parts Per Million

Site	Map* No.	Maximum Reading			Arith. Aver.	Number of Readings Exceeding			
		1-hour	3-hour	24-hour		1-hour of 0.25	3-hour of 0.50	24-hour of 0.10	24-hour of 0.14
C-Hill	18	2.54	1.61	0.37	0.016	125	20	15	9
Hiway Jct.	2	1.58	1.33	0.60	0.023	180	17	22	9
Mill Creek RR	5	1.36	0.74	0.16	0.014	59	1	6	1
Post Office	1	1.02	0.68	0.14	0.009	49	2	2	1
Pumphouse	12	0.40	0.21	0.06	0.006	5	0	0	0

*See Figure 12

TABLE 26
Total Suspended Particulate Data Yearly Summary Butte-Anaconda
Jan. 1976 - Dec. 1976

Station*	Minimum	Frequency Distribution (% of values equal to or less than stated one)								Maximum	Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	Number of Samples Reported Per Month											
		10%	30%	50%	70%	90%	95%	98%	Jan.							Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Sil Bow Gen Butte	18	30	42	51	68	99	109	144	173	59.29	29.42	55.52	1.22	52	4	4	4	6	5	5	5	5	3	6	2	2	2
Greeley Sch Butte	16	48	68	98	133	173	179	255	285	106.51	55.89	92.51	1.38	43	4	4	6	5	5	5	4	3	3	4	0	0	0
Atkins Butte	10	21	33	44	61	102	137	182	306	58.89	51.01	46.31	1.57	47	3	4	6	5	5	3	4	5	2	6	2	2	2
Richer Res. Butte	4	10	15	17	24	29	38	39	42	19.55	8.51	17.75	1.23	51	4	4	6	5	5	5	4	5	3	6	2	2	2
Hiway Jct. Deer Lodge	3	17	30	45	54	76	109	151	250	50.88	39.30	40.62	1.65	52	5	4	6	5	4	4	5	4	4	5	1	5	5
Tierney Res. Sil Bow Co.	8	12	26	33	42	54	58	64	202	36.96	27.59	31.28	1.39	50	4	4	6	5	5	5	3	5	3	6	2	2	2

*See Figure 13 for locations of many of the sites.

TABLE 27

SULFATION RATE DATA

Yearly Summary Anaconda Area - 1976

Values in Milligrams Sulfur Trioxide

Per 100 Square Centimeters per Day

Site	Map* No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
Hiway Jct.	2	2.57	1.01	11	7	0.47	0.60
Lost Creek	20	0.24	0.24	6	0	---	---
Durant Canyon	10	0.13	0.11	3	0	0.12	0.28
A-Hill	13	0.02	0.01	3	0	0.06	---
B-Hill	14	0.70	0.34	12	2	0.02	----
C-Hill	18	1.04	0.67	6	5	---	---
D-Hill	15	1.15	0.54	7	3	0.02	----
E-Hill	16	1.12	0.47	12	4	0.03	----
F-Hill	17	0.70	0.25	8	2	0.00	----
G-Hill	21	1.87	1.16	7	6	---	----
H-Hill	22	0.45	0.28	8	0	---	---

*See Figure 12

Butte Area

A study was continued in the Butte area for particulate emissions. The major source in the area is the large open pit mine. Emissions from transferring ore and heavy duty vehicle traffic emit large quantities of particulates, sulfur dioxide, hydrocarbons and oxides of nitrogen. Estimates of particulates alone average some 6000 tons per year (see Table 28). Particulate matter from this mine settles over the city and is re-entrained by vehicle traffic on city streets. Other sources in the area include a tepee burner, three hot mix plants, and a concentrator and crusher that process the ore from the mine. These sources, although insignificant compared to the emissions from the mine, do contribute to the overall pollution level.

Table 26 summarizes the data collected in the area. The map in Figure 13 shows the relative locations of the mine and the air monitors. Violations of federal secondary and state particulate standards occurred frequently in the area. The Greeley School and Atkins sites recorded the highest annual geometric means with values of 92.5 and 53.5 $\mu\text{g}/\text{m}^3$, respectively.

The Butte-Anaconda area is also the subject of a plan being written to maintain the air quality in compliance with ambient air quality standards through 1985. The plan (Air Quality Maintenance Plan) is being written for particulates and sulfur dioxide.

TABLE 28

Emission Sources at The Berkeley Open Pit Mine*

Source	Pollutant Emissions (Tons Per Year)	
	Particulates	Sulfur Dioxide
Truck Exhaust	352	199
Other Equipment Exhaust	5	8
Blasting	36	---
Haul Roads	3010	---
Parking Lot	10	---
Shovel Operation	1425	---
Road Maintenance and Repair	184	---
Bulldozers and Front- end loaders	460	---
Truck Dumping	569	---
Dragline	29	---
TOTAL	6080	207

* Reference (PEDCo, 1976)

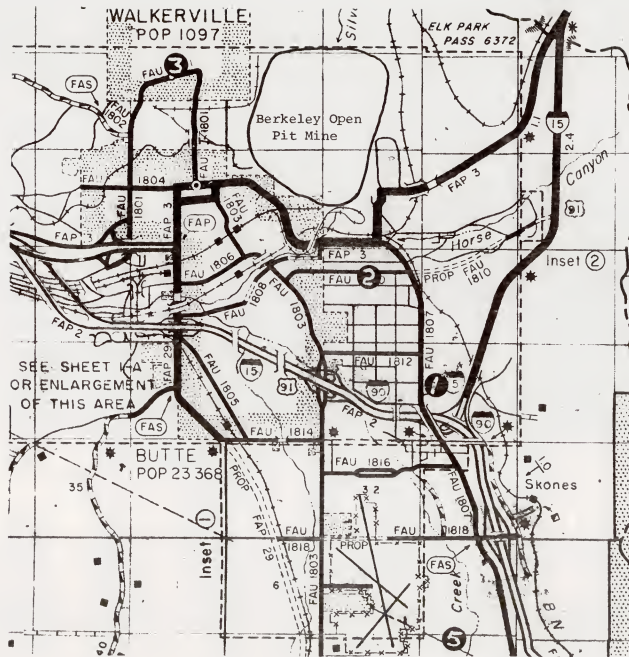


FIGURE 13

Butte Area

Ambient Air Monitors

<u>Map No.</u>	<u>Site Name</u>
1	Silver Bow Gen Hosp
2	Greeley School
3	Atkins
5	Richer Residence

Scale: 1 inch = 1 mile

Ramsay Area

An ambient air quality study was continued in the Ramsay area by the DHES. This study was conducted around an elemental phosphorus plant at Silverbow, Montana, This phosphorus plant emits significant quantities of fluorides, sulfur dioxide and particulates (See Table 5).

Sampling was conducted for gaseous fluorides and particules in the area. Figure 14 shows the relative locations of samplers and the source. Tables 29 and 30 summarize the gaseous fluoride data. The results for sampling of particulate matter are summarized at the bottom of Table 26. The state ambient air quality standard for fluorides was violated on many occasions in the area. Particulate sampling in the area (Tierney Res.) recorded a maximum 24-hour value of 202 ug/m^3 and an annual geometric mean of 31.3 ug/m^3 . Sampling fluoride recorded a maximum one-month reading at the ESE of Stauffer site of $7.87 \text{ ug/cm}^2/30\text{days}$. This site also recorded the highest annual average of $3.22 \text{ ug/cm}^2/30 \text{ days}$. Tables 29 and 30 also show average concentrations for 1975 and 1974 for comparison.

The phosphorus plant is presently operating under an Order of Compliance which provides for compliance with the visible emission and fluoride rules by March, 1978.

FIGURE 14

Ramsay Area

Ambient Air Monitors

<u>Map No.</u>	<u>Site Name</u>
1	Ramsay West
2	Ramsay North
4	ESE of Stauffer
5	S of Stauffer
6	S of Stauffer Pon
7	Stauffer Pond #1
8*	Stauffer Pond #2
9	Montana Power Sub
10	Tierney Res.
11	Stauffer West

*Same location as #7.

Major Point Source

<u>Map No.</u>	<u>Source Name</u>
A	Stauffer Chem. Co.

Scale: 1 inch = 0.75 miles



TABLE 29

Gaseous Fluoride Data (Calcium Formate Paper)

Yearly Summary Silver Bow County - 1976

Values in Micrograms per Square Centimeter/30 days

Site	Map**		Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
	No.	Max.					
Ramsay West	1	1.75	1.03	12	12	1.34	1.55
Ramssay North	2	0.91	0.42	12	4	0.58	0.52
ESE of Stauffer	4	7.87	3.22	12	12	3.00	4.93
S. of Stauffer	5	1.61	1.02	12	12	0.95	1.53
S. of Stauffer Pond	6	1.99	1.02	12	12	1.38	1.53
Stauffer Pond #1*	7	1.12	0.54	7	3	8.45	0.83
Stauffer Pond #2*	8	3.04	2.22	4	4	3.07	3.97
Montana Power Sub.	9	3.91	1.55	12	12	2.15	--
Stauffer West	10	1.72	1.32	2	2	--	--

*Pond Sites (Standard applies is pond emission source)

** See Figure 14

TABLE 30

Gaseous Fluoride Data (Sodium Formate Plates)

Yearly Summary Silver Bow County - 1976

Values in Micrograms per square centimeter/30 days

Site	Map**		Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
	No.	Max.					
Ramsay West	1	2.17	1.31	9	9	1.61	2.10
Ramsay North	2	1.00	0.75	5	5	0.65	0.94
ESE of Stauffer	4	10.92	3.89	9	9	3.14	5.40
S. of Stauffer	5	1.35	1.03	7	7	1.18	2.00
S. of Stauffer Pond	6	2.20	1.20	9	9	1.26	1.53
Stauffer West	10	1.82	1.19	4	4	--	--

**See Figure 14

Garrison Area

The Garrison area was sampled for fluorides and particulates around a phosphate feed plant by the DHES. The plant had emitted large quantities of fluorides and particulate matter. Late in 1975, the plant abruptly shut down. Prior to ceasing operation, a plan was being worked out for controlling the fluorides (emitted from both the stack and settling pond) and particulates. Sampling was continued during 1976 to establish a background concentration of fluorides in the area in the event the plant would be re-opened.

Tables 31 and 32 summarize the fluoride data for the area. Figure 15 shows the relative locations of the source and air monitors. The state fluoride standard continued to be violated early in the year but concentrations dropped significantly toward the end of 1976. Sampling with fluoride papers (Calcium Formate Paper) recorded a maximum one-month value of $9.61 \text{ ug/cm}^2/30 \text{ days}$ and annual average of $2.16 \text{ ug/cm}^2/30 \text{ days}$. The table 31 also shows a comparison of 1976 values with average values of 1975 and 1974. Table 32 shows similar results using fluoride plates (Sodium Formate Plates). Comparison is also made with previous year's averages.

FIGURE 15

Garrison Area

Ambient Air Monitors

Map No.	Site Name
1	Beck
2	Mullenberg
3	RMP A
4	Lahman
5	E. Garrison
6	N. Across Hwy.
7	W. in Garrison
8*	RMP B
9	Gerdt's
10*	Pond Edge #1
11*	Pond Edge #2

*Same location as #3

Major Point Source

Map No.	Source Name
A	Rocky Mtn. Phos., Inc.

Scale: 1 inch = 1 mile

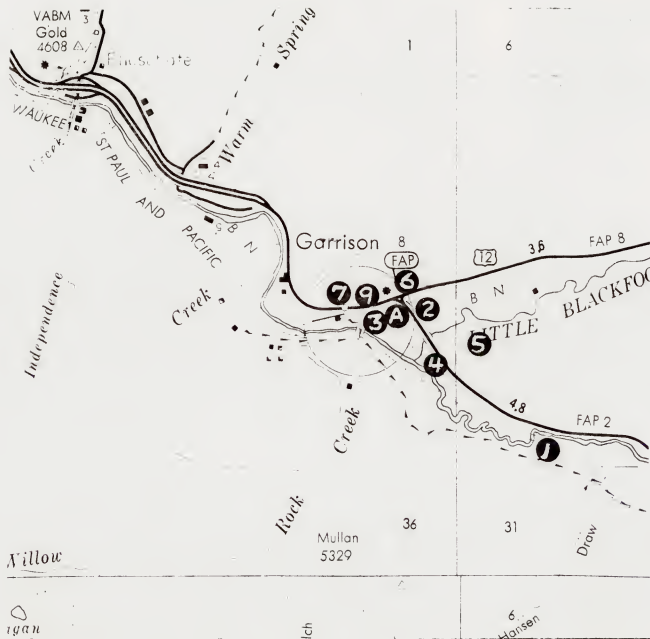


TABLE 31

Gaseous Fluoride Data (Calcium Formate Paper)

Yearly Summary Powell County

Values in micrograms of fluoride per square centimeter for 30 days

Site	Map** No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
Beck	1	0.56	0.13	6	1	0.42	0.78
Mullenburg	2	2.93	0.59	6	1	2.39	8.09
RMP A	3	9.61	2.16	7	1	7.69	23.89
Lahman	4	1.38	0.28	6	1	1.75	5.59
E. Garrison	5	1.05	0.22	6	1	1.12	2.15
N. Across Hwy.	6	2.87	0.58	6	1	3.73	10.32
W. in Garrison	7	0.46	0.12	6	1	0.54	1.35
RMP B	8	2.87	1.17	3	3	3.46	15.04
Gerdts	9	0.69	0.69	3	3	1.76	1.41
Ponds Edge #1*	10	6.69	2.54	3	1	27.38	100.41
Ponds Edge #2*	11	25.95	4.56	6	1	48.77	131.60

*Pond Sites (Standard applies is pond emission source)

TABLE 32

Gaseous Fluoride Data (Sodium Formate Plates)

Yearly Summary Powell County

Values in micrograms of fluoride per square centimeter per 30 days

Site	Map** No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
Beck	1	0.53	0.10	6	1	0.46	1.18
N. Across Hwy.	6	2.84	1.48	2	1	3.92	10.02
RMP B	8	3.66	0.83	5	1	4.69	18.43
NW on Hill	12	2.48	0.48	6	1	3.02	9.50
Gerdts	9	0.0	0.0	3	0	2.04	2.42

**See Figure 15.

Colstrip

In Region 143 a special study was performed in the Colstrip area. The study was conducted around the two large power plants. The first plant started operation in the latter part of 1975, while second plant started during mid-1976. The new plants are sources of particulate, sulfur dioxide, oxides of nitrogen, hydrocarbons, carbon monoxide and many trace elements. Table 7 shows the emissions of particulates and sulfur dioxide.

Sampling was performed for many of the pollutants emitted by the source before and after construction and start up of the plants. No attempt was made to separate the data before and after startup in this report. The background data is the subject of another report (Gelhaus, 1976). It is anticipated that a comparison report will be written in the near future.

Figure 16 shows the relative locations of the samplers and the source for the Colstrip area. Tables 33 and 39 summarize the data for the Colstrip area. Results show very low concentrations of all pollutants except ozone and non-methane hydrocarbons. The highest particulate concentrations were recorded at the BN site with a maximum 24-hour value of 104 ug/m^3 and an annual geometric mean of 28.3 ug/m^3 . Near zero concentrations of sulfur dioxide and oxides of nitrogen were measured in the studies. Non-methane hydrocarbons at the BN site (Rosebud County) showed a maximum 1-hour value of 2.00 ppm. Ozone values were recorded in excess of the federal 1-hour standard with the BN site recording maximum 1-hour readings of 0.09 ppm. Fluoride concentrations were also very near zero with the maximum one-month value of $0.02 \text{ ug/cm}^2/30 \text{ days}$ recorded at the BN site.

FIGURE 16

Colstrip Area
Rosebud County

Ambient Air Monitors

<u>Map No.</u>	<u>Site Name</u>
1	BN Site
2	McRae Site
3	Halfway
4	Antenna Hill
5	Sewage Lagoon

Major Point Sources

<u>Map No.</u>	<u>Source Name</u>
A	Montana Power

Scale: 1 inch = 2 mil

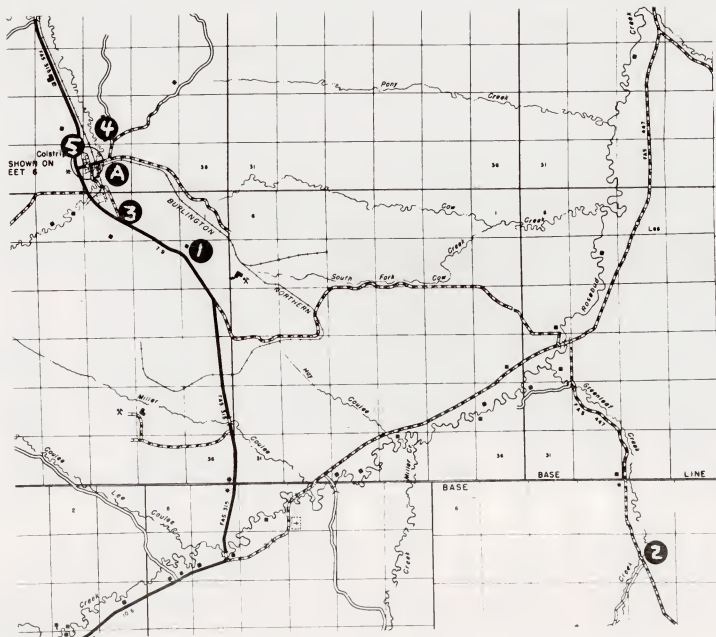


TABLE 33
Total Suspended Particulate Data Yearly Summary McRae & BN Sites - Colstrip
Jan. 1976 - Dec. 1976

Station	Minimum	Frequency Distribution (% of values equal to or less than stated one)								Maximum	Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	Number of Samples Reported Per Month											
		10%	30%	50%	70%	90%	95%	98%	Jan.							Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
McRae Site Rosebud Co.	4	8	11	16	24	37	42	73	86	20.44	15.11	16.52	1.52	106	8	8	7	10	11	7	4	11	10	10	10	10	
BN Site Rosebud Co.	6	11	20	30	41	64	72	92	104	34.05	20.77	28.33	1.48	109	10	8	7	10	11	8	4	11	10	10	10	10	

TABLE 34
Continuous Monitor Data
Yearly Summary Rosebud County
Values in Parts Per Million

Site	Map* No.	Pollutant	Maximum Reading				Arith. Aver.	Standards Exceeded			
			1-Hour	3-Hour	8-Hour	24-Hour		1-Hour	3-Hour	8-Hour	24-Hour
BN Site	1	Total Hydrocarbons	3.50	2.47	---	2.07	1.604	---	---	---	---
		Methane HC	2.00	2.00	---	1.87	1.593	---	---	---	---
		Non-Methane HC	2.00	0.87	---	0.48	0.012	---	5	---	---
		Nitric Oxide	0.0	0.0	---	0.0	0.0	---	---	---	---
		Nitrogen Dioxide	0.0	0.0	---	0.0	0.0	---	---	---	---
		Oxides of Nitrogen	0.0	0.0	---	0.0	0.0	---	---	---	---
		Ozone	0.09	0.09	---	0.08	0.049	43	---	---	---
		Sulfur Dioxide	0.02	0.01	---	0.0	0.0	0	0	---	0

*See Figure 16

TABLE 35

Sulfur Dioxide Bubbler Data
 Yearly Summary Colstrip Area - 1976
 Values in Parts Per Million

Site	Map+ No.	Geometric Mean	Arithmetic Mean	Maximum* 24-Hour Value	1975 A. Mean	1974 A. Mean
BN Site	1	0.0000	0.0000	0.000	0.0000	0.0001
McRae Site	2	0.0001	0.0011	0.015	0.0000	0.0001

*Minimum detectable level is 0.01 ppm for 24 hours.

+See Figure 16

TABLE 36

Nitrogen Dioxide Bubbler Data
 Yearly Summary Colstrip Area - 1976
 Values in Parts Per Million

Site	Map+ No.	Geometric Mean	Arithmetic Mean	Maximum* 24-Hour Value	1975 A. Mean	1974 A. Mean
BN Site	1	0.0004	0.0024	0.006	0.0023	0.0013
McRae Site	2	0.0000	0.0002	0.015	0.0015	0.0013

+See Figure 16

*Minimum detectable level is 0.003 ppm for 24 hours.

TABLE 37

Sulfation Rate Data

Yearly Summary Colstrip Area - 1976

Values in milligrams sulfur trioxide per 100 square centimeters per day

Site	Map* No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
BN Site	1	0.12	0.05	9	0	0.00	0.03
McRae Site	2	0.05	0.01	11	0	0.01	0.01
Halfway Site	3	0.08	0.02	12	0	0.0	0.02
Antenna Hill	4	0.08	0.02	9	0	0.00	0.02
Sewage Lagoon	5	0.24	0.09	12	0	0.05	0.08

TABLE 38

Gaseous Fluoride Data (Calcium Formate Paper)

Yearly Summary Colstrip Area - 1976

Values in micrograms of fluoride/square centimeter/30 days

Site	Map* No.	30 Days Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
BN Site	1	0.02	0.02	8	0	0.02	0.01
McRae Site	2	0.01	0.01	8	0	0.00	0.01

TABLE 39

Gaseous Fluoride Data (Sodium Formate Paper)

Yearly Summary Colstrip Area - 1976

Values in micrograms of fluoride/square centimeter/30 days

Site	Map* No.	30 Days Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
BN Site	1	0.0	0.0	9	0	0.0	0.03
McRae Site	2	0.0	0.0	12	0	0.0	0.01
Halfway Site	3	0.0	0.0	12	0	0.0	0.02
Antenna Hill	4	0.0	0.0	9	0	0.0	0.01

*See Figure 16

Missoula Area

In Region 144, a special study was continued in the Missoula area by the Missoula City-County Health Department. This study is orientated both for population and point-source type pollution sources.

The major industrial sources of air pollution in the Missoula Valley study area are, by and large, wood products plants. A pulp and paper mill, two plywood plants and a particle board plant are the major emitters. A number of sawmills also contribute their emissions to Missoula's air. Table 40 summarizes emission estimates for the major point sources in the area.

Table 41 and 42 summarize the ambient air quality data collected in the area. Figure 17 shows the relative locations of the sources and air monitors. Samples were taken for particulates, sulfur dioxide and nitrogen dioxide. Sulfur dioxide was monitored only briefly with none detected. Nitrogen dioxide was monitored also briefly with no violations being recorded. Particulate levels were in excess of both federal primary and state ambient air quality standards at several locations in the area. The Courthouse site was the only site recording a reading in excess of the federal primary standard with a maximum 24-hour reading of 386 ug/m^3 . The Courthouse site had the highest annual geometric mean with a value of 86.1 ug/m^3 , which is in excess of the federal primary standard.

Compliance schedules have been established for some of the point sources in the area. Final compliance for the particleboard plant is scheduled for October of 1977 and one lumber mill is scheduled for final compliance by July 1977. The one plywood plant achieved final compliance in late 1976. The two former programs will result in reduction of particulate emissions of about 75% from lumber mill and more than 90% from the particleboard plant.

Missoula County is also the subject of an Air Quality Maintenance Plan for maintaining particulate and carbon monoxide levels with the standards through 1985.

TABLE 40
MISSOULA AREA MAJOR SOURCES
ESTIMATED EMISSIONS

Point Sources	SO ₂	Pollutant (Tons Per Year)				TRS*
		Part.	NO _x	HC	CO	
Evans Products (particleboard)	Neg.	706	153	75	150	
Evans Products (plywood)	34	246	228	151	46	
Hoerner Waldrof	910	988	1008	115	1350	675
Intermountain Lumber	8	49	55	11	11	
Missoula White Pine Sash	9	164	61	12	12	
U.S. Plywood	224	842	1472	297	298	

* TRS - Total Reduced Sulfur

FIGURE 17

Missoula Area
Missoula County

Ambient Air Monitors

Map No.	Site Name
1	Courthouse
2	J-B Field
5	Frenchtown

Major Point Sources

Map No.	Source Name
A	Hoerner Waldorf
B	U. S. Plywood
C	Evans Products (particleboard)
D	Evans Products (plywood)

Scale: 1 inch = 2 miles

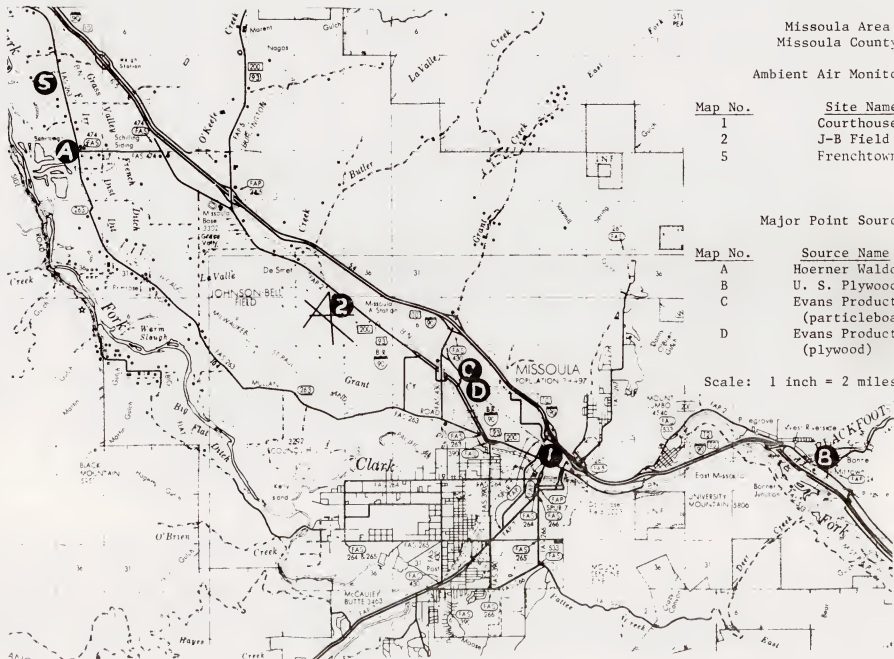


TABLE 41

TOTAL SUSPENDED PARTICULATE DATA YEARLY SUMMARY MISSOULA COUNTY

Jan. 1976 - Dec. 1976

Station*	Minimum	Frequency Distribution (% of values equal to or less than stated one)								Maximum	Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	Number of Samples Reported per Month											
		10%	30%	50%	70%	90%	95%	98%	Jan.							Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Courthouse	11	45	66	83	111	170	221	274	386	100.24	60.13	86.08	1.36	340	29	27	28	22	25	29	31	30	29	29	30	31	
J-B Field	6	17	31	45	65	103	132	160	214	54.73	37.57	43.64	1.62	354	29	28	31	30	29	25	31	30	30	30	30	31	
Frenchtown	6	16	25	34	48	79	100	118	217	41.86	27.84	34.64	1.47	360	31	28	30	29	31	30	30	30	30	30	30	31	

TABLE 42

Bubbler Data Yearly Summary Missoula County

Values in Parts Per Million

Site	Map* No.	Geometric Mean	Sulfur Dioxide		Geometric Mean	Nitrogen Dioxide	
			Arithmetic Mean	Maximum 24-Hour Value		Arithmetic Mean	Maximum 24-Hour Value
Courthouse Missoula	1	0.00	0.00	0.00	0.0123	0.0323	0.084

*See Figure 17

Columbia Falls Area

A special study was continued in the Columbia Falls area by DUES. This study is orientated toward an aluminum reduction plant.

The aluminum plant and several wood products plants are the major industrial emission sources in the Flathead Valley. Estimates of annual particulate emissions of the aluminum plant are presented in Table 9.

Tables 43 and 44 summarize the ambient air quality data for the Columbia Falls area. The map in Figure 18 shows the relative locations of the aluminum plant and related air monitors. Results of sampling in the area show fluoride levels in excess of state ambient air quality standards at many locations in the Columbia Falls area. Fluoride sampling with Calcium Formate Papers resulted in the maximum one-month reading at the Teakettle Mtn. #10 (TK #10) of $19.70 \text{ ug/cm}^2/30 \text{ days}$. The Teakettle Mtn. #10 (TK #10) site also recorded the highest annual average fluoride concentration with a value of $5.20 \text{ ug/cm}^2/30 \text{ days}$. Tables 43 and 44 also show the average concentrations recorded during 1975 and 1974 for comparison.

The aluminum plant is currently on a compliance schedule which provides for compliance by June of 1979. This should reduce fluoride emissions by about 65% and particulate emissions by about 45%.

The Columbia Falls area is also presently the subject of a meteorological study and the northern Flathead Valley is the subject of a particulate study, both of which will be reported on in the near future.

FIGURE 18

Kalispell-Columbia Falls
Area

Ambient Air Monitors

Map No.	Site Name
1	Dehlbom Res.
2	Feirstein
3	R E Owen
4	Badrock
5	Dehlbom Field
6	Anaconda S
7	Teakettle #1
8	Teakettle #2
9	Teakettle #3
10	Teakettle #4
11	Teakettle #5
12	Teakettle #6
13	Teakettle #9
14	Teakettle #10
15	Teakettle #11
16	Teakettle #12
17	Aluminum City
18	Trailer
19	Kenas Residence
20	Columbia Falls H.

Major Point Sources

Map No.	Source Name
A	Anaconda Aluminum

Scale: 1 inch = 0.80 mil

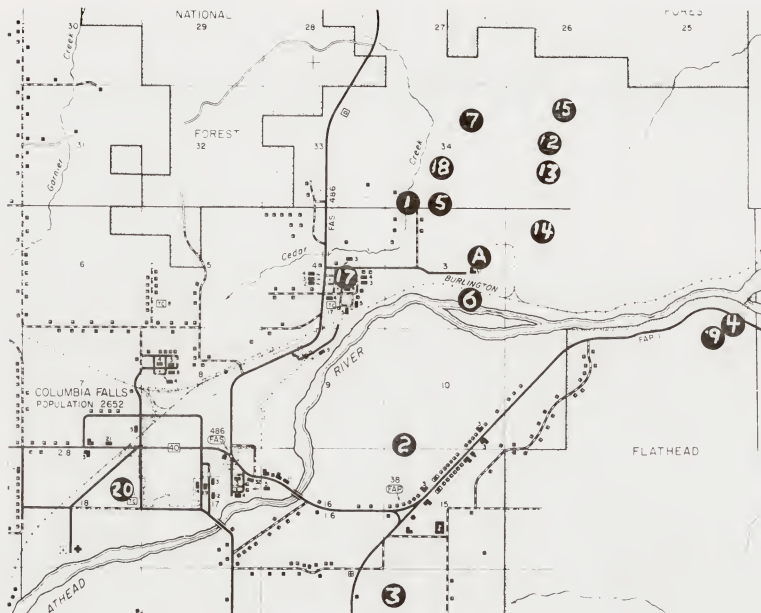


TABLE 43

GASEOUS FLUORIDE DATA (SODIUM FORMATE PLATES) YEARLY SUMMARY COLUMBIA FALLS AREA
VALUES IN MICROGRAMS FLUORIDE PER SQUARE CENTIMETER PER 30 DAYS

Site	Map+ No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
Dehlbom Res.	1	1.84	0.93	12	10	0.61	1.41
Feirstein	2	0.98	0.43	9	5	0.50	0.98
R. E. Own	3	0.59	0.25	12	3	0.16	0.37
Badrock Sta.	4	2.62	0.62	12	9	0.28	0.52
Dehlbom Field	5	1.25	0.76	12	10	0.73	1.29
Anaconda S	6	8.82	4.99	11	11	5.12	8.26
TK #1	7	4.83	1.22	8	3	2.89	7.00
TK #6	12	18.67	9.27	3	3	4.25	6.52
TK #7	NS**	0.69	0.63	2	2	0.45	0.57
TK #8	NS	0.75	0.48	9	7	0.45	5.64
TK #9	13	8.33	8.10	2	2	2.64	15.67
TK #10	14	35.56	13.24	8	8	5.12	3.07
TK #11	15	8.06	4.83	8	8	2.88	12.21
Aluminum City	17	2.26	1.07	10	8	0.96	1.79
Trailer	18	2.06	1.20	12	11	0.86	0.48
Kenas Res.	19	4.90	1.49	8	6	0.56	---
Hamilton #2	NS	0.16	0.16	2	0	----	---
Glacker Park #1	NS	0.72	0.41	12	8	0.22	0.60
Glacier Park #2	NS	0.81	0.44	11	7	0.26	----
Glacker Park #3	NS	0.18	0.07	12	0	0.0	----
Glacker Park #4	NS	0.0	0.0	11	0	0.0	----
Glacier Park #5	NS	0.15	0.02	7	0	0.0	----
Glacier Park #6	NS	0.32	0.06	11	1	0.0	----
Glacier Park #7	NS	0.57	0.37	12	6	0.18	----
Glacier Park #8	NS	0.34	0.21	12	2	0.06	----
Glacier Park #9	NS	0.51	0.36	12	7	0.17	----
Glacker Park #10	NS	0.46	0.32	12	7	0.17	----

+See Figure 18

** NS - Monitor locations not shown on map

TABLE 44

GASEOUS FLUORIDE DATA (CALCIUM FORMATE PAPER) YEARLY SUMMARY COLUMBIA FALLS AREA
VALUES IN MICROGRAMS FLUORIDE PER SQUARE CENTIMETER PER 30 DAYS

Site	Map+ No.	Max.	Annual Aver.	No. Samples	Months Standard Exceeded	1975 Aver.	1974 Aver.
Dehlbom Res.	1	1.71	0.78	12	9	0.46	1.02
Feirstein	2	1.32	0.58	12	10	0.36	0.67
R. E. Owen	3	0.52	0.27	12	6	0.12	0.26
Badrock Sta.	4	1.85	0.52	12	8	0.20	0.39
Dehlbom's Field	5	1.27	0.72	12	10	0.56	0.85
Anaconda S	6	9.65	4.36	12	12	4.44	9.11
TK #1	7	3.52	1.95	11	11	2.68	7.33
TK #6	12	9.16	1.70	8	6	4.14	8.18
Hamilton #1	NS**	1.70	0.68	10	10	0.40	1.39
TK #7	NS	0.48	0.34	2	1	0.23	0.58
TK #8	NS	0.65	0.34	9	4	0.25	0.58
TK #9	13	8.98	4.03	9	8	4.49	5.72
TK #10	14	19.70	5.20	9	8	3.25	8.33
TK #11	15	6.28	4.54	7	7	2.25	3.76
Aluminum City	17	1.97	0.89	12	9	0.47	1.07
Trailer	18	1.97	1.10	12	10	0.71	1.48
Kenas Res.	19	5.60	1.25	8	6	0.30	---
Hamilton #2	NS	0.29	0.26	4	0	---	---
Glacier Park #1	NS	0.58	0.30	11	3	0.16	0.38
Glacier Park #2	NS	0.58	0.36	11	6	0.19	0.28
Glacier Park #3	NS	0.16	0.08	12	0	0.03	---
Glacier Park #4	NS	0.08	0.04	12	0	0.01	---
Glacier Park #5	NS	0.08	0.03	12	0	0.01	---
Glacier Park #6	NS	0.15	0.10	12	0	0.04	---
Glacier Park #7	NS	0.55	0.34	12	6	0.17	---
Glacier Park #8	NS	0.33	0.23	12	2	0.10	---
Glacier Park #9	NS	0.61	0.37	12	7	0.16	---
Glacier Park #10	NS	0.56	0.33	12	7	0.13	---

+See Figure 18

** NS - Monitor locations not shown on map

Eastern Montana

In Region 140 and 141 studies were performed on the background air quality for large areas of eastern Montana. These studies were mainly performed to establish a general background air quality level prior to coal development.

Sampling was performed for particulates, nitrogen dioxide, and sulfur dioxide. Figure 19 shows the general locations of the samplers. Sulfur dioxide and nitrogen dioxide were sampled only at the Scobey and Ft. Peck sites.

The results of the sampling are presented in Table 45, 46 and 47. The results show very low concentrations of sulfur dioxide and nitrogen dioxide. Particulate concentrations vary from site to site with the maximum 24-hour concentration recorded of 208 ug/m^3 at the Morton site. The highest geometric average concentration was 60.1 ug/m^3 which was also recorded at the Morton site. This site is located near a strip mine which causes the particulate concentrations to exceed those of other eastern Montana area. These concentrations are not typical of the remainder of the eastern Montana area.

FIGURE 19
Eastern Montana
Ambient Air Monitors

Map No.	Site Name
1	Scobey
2	Poplar
3	Ft. Peck
4	Lindsay (2)
5	Glendive
6	Miles City
7	Lame Deer
8	Broadus
9	Big Horn Co. (2)

Scale: 1 inch = 22 miles

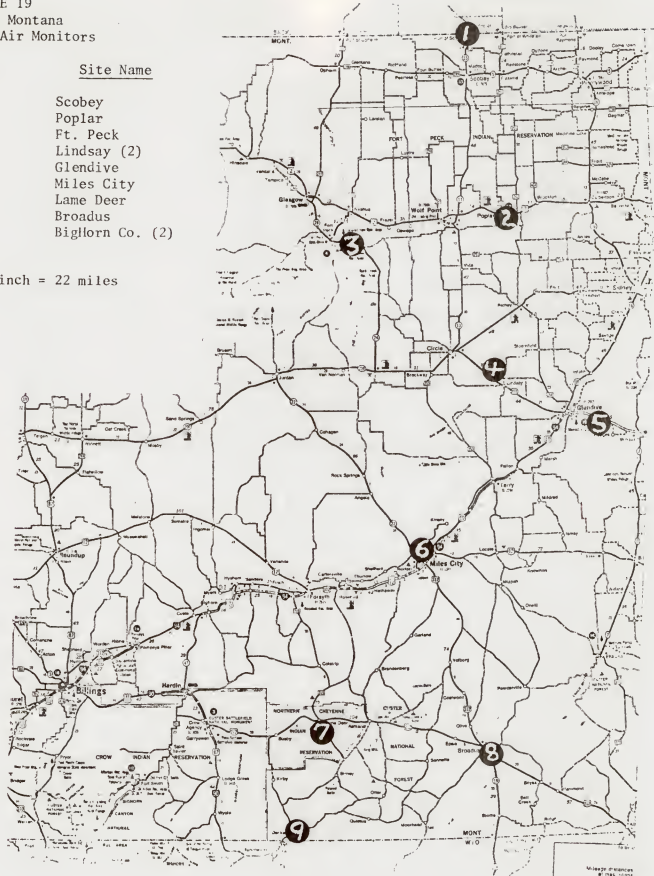


TABLE 45
TOTAL SUSPENDED PARTICULATE DATA YEARLY SUMMARY
Eastern Montana
Jan. 1976 - Dec. 1976

Site	Frequency Distribution (% of Values Equal to or less than stated one)									Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	No. Samples Reported Per Month											
	Min.	10%	30%	50%	70%	90%	95%	98%	Max.						Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Morton BigHorn Co.	16	18	36	64	94	168	185	202	208	78.38	55.48	60.09	1.79	52	3	4	4	5	5	4	4	5	4	5	5	4
Warren Ranch BigHorn Co.	1	9	17	22	33	63	85	98	146	32.51	27.32	24.18	1.95	55	6	4	5	5	4	4	4	4	5	5	5	4
Littlefield Miles City	4	7	13	19	26	50	75	85	87	24.88	20.22	19.01	1.74	41	2	4	6	4	2	4	3	0	3	5	5	3
Scobey Daniels Co.	9	12	17	25	44	67	86	86	98	34.96	24.51	27.75	1.63	26	0	0	4	3	5	5	4	3	2	0	0	0
Glendive Dawson Co.	5	12	20	30	39	46	82	99	102	33.15	21.64	27.39	1.53	39	0	3	4	2	5	2	3	3	4	3	5	5
Lindsay (107349) Dawson Co.	2	4	9	13	25	30	34	36	38	16.61	10.51	13.03	1.80	33	1	4	6	3	2	1	1	3	4	3	3	2
Lindsay (107312) Dawson Co.	3	4	9	16	24	36	40	42	60	18.85	13.35	14.51	1.81	34	1	5	5	4	3	5	1	3	3	2	1	1
Fort Peck McCone Co.	1	5	16	21	30	57	77	91	166	30.74	30.68	21.08	2.48	35	1	4	3	5	4	1	4	1	4	3	4	1
Broadus Powder River Co.	3	6	11	16	23	40	45	49	62	19.79	13.52	15.56	1.71	58	6	4	3	5	5	5	5	5	5	5	5	5
Poplar Roosevelt Co.	4	9	14	25	34	59	82	132	173	33.86	32.01	24.93	1.83	43	6	4	6	5	5	4	4	4	4	1	0	0
Lame Deer Rosebud Co.	1	6	9	16	23	30	37	131	131	23.61	28.43	15.42	2.69	18	0	0	0	0	0	4	4	4	3	0	0	0

TABLE 46

SULFUR DIOXIDE BUBBLER DATA

Yearly Summary Eastern Montana - 1976

Values in Parts Per Million

Site	Map+ No.	Geometric Mean	Arithmetic Mean	Maximum* 24-Hour Value	1975 A. Mean	1974 A. Mean
Fort Peck McCone Co.		0.0000	0.0000	0.000	0.0000	---
Lame Deer Rosebud Co.		0.0000	0.0001	0.001	0.000	---
Scobey Daniels Co.		0.0000	0.0000	0.000	---	---

*Minimum detectable level is 0.01 ppm for 24 hours

+ See Figure 19

TABLE 47

NITROGEN DIOXIDE BUBBLER DATA

Yearly Summary Eastern Montana - 1976

Values in Parts Per Million

Site	Map+ No.	Geometric Mean	Arithmetic Mean	Maximum* 24-Hour Value	1975 A. Mean	1974 A. Mean
Fort Peck McCone Co.		0.0002	0.0046	0.085	0.0050	---
Lame Deer Rosebud Co.		0.0004	0.0029	0.011	0.0038	---
Scobey Daniels Co.		0.0002	0.0040	0.015	---	---

*Minimum detectable level is 0.03 ppm for 24 hours

+ See Figure 19

Western Montana

In Region 142 and 144 studies were performed around local sources of air pollution for several areas in western Montana. These studies were generally for assessing levels of particulate matter.

Figure 20 shows the general locations of the samplers. The results of the sampling are presented in Table 48. The results vary with each site. The highest concentrations were recorded around the Andero's Resin Columbia Falls with a maximum 24-hour particulate concentration of 294 ug/m^3 and an annual geometric average of 97.74 ug/m^3 .

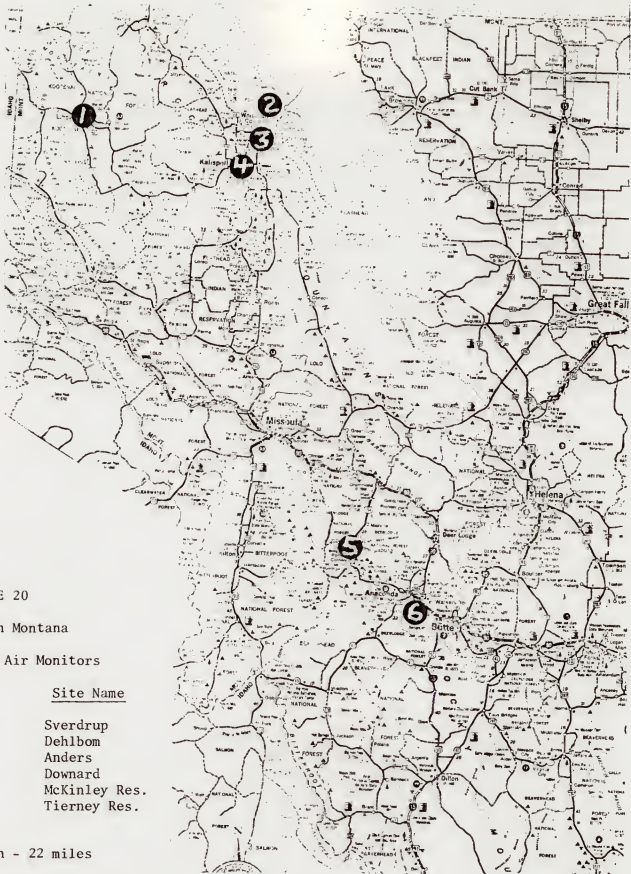


FIGURE 20

Western Montana

Ambient Air Monitors

Map No.	Site Name
1	Sverdrup
2	Dehlbom
3	Anders
4	Downard
5	McKinley Res.
6	Tierney Res.

Scale: 1 inch - 22 miles

TABLE 48

TOTAL SUSPENDED PARTICULATE DATA YEARLY SUMMARY

Western Montana

Jan. 1976 - Dec. 1976

Site	Minimum	Frequency Distribution (% of Values Equal to or Less Than Stated One)								Maximum	Arith. Mean	Arith. Std. Dev.	Geo. Mean	Geo. Std. Dev.	Total No. Obs.	No. Samples Reported Per Month											
		10%	30%	50%	70%	90%	95%	98%	Jan							Feb	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Anders Res. Columbia Falls	19	29	75	93	143	231	254	292	294	122.13	75.99	97.74	1.70	38	0	1	5	2	6	2	0	3	5	5	5	4	
Dehlbom Res. Flathead Co.	1	5	12	18	20	40	48	53	53	19.14	13.38	14.66	2.09	21	1	2	5	2	2	4	5	0	0	0	0	0	
McKinley Res. Granite Co.	1	4	14	33	50	82	94	138	147	39.96	34.53	24.18	4.21	57	6	4	5	5	6	5	5	3	4	4	5	5	
Downard Res. Kalispell	14	36	70	105	132	201	213	214	234	109.48	57.24	92.48	1.53	31	4	1	4	4	4	4	5	4	1	0	0	0	
Sverdrup Libby	26	31	38	60	65	78	80	113	113	57.13	22.88	53.00	1.18	16	5	3	0	1	2	0	0	1	3	1	0	0	
Tierney Res. Silver Bow	8	12	26	33	42	54	58	64	202	36.96	27.59	31.28	1.39	50	4	4	6	5	5	5	3	5	3	6	2	2	

REFERENCES

An Air Quality Assessment of Colstrip, Montana, Prior to Development to Coal-Fired Power Plants by James W. Gelhaus , Montana Department of Health and Environmental Sciences, January 1976.

Preliminary Draft Anaconda - Butte AQMA Analysis by PEDCo - Environmental Sepcialists, Inc., July 1976.

APPENDIX A

Federal Ambient Air Quality Standards

Pollutant	Primary		Secondary		Averaging Time
	($\mu\text{g}/\text{m}^3$)	(ppm)	($\mu\text{g}/\text{m}^3$)	(ppm)	
Particulates	75	---	60	---	Annual
	260*	---	150*	---	24-Hour
Sulfur Dioxide	80	0.03	---	---	Annual
	365*	0.14	---	---	24-Hour
	---	---	1,300*	0.5	3-Hour
Carbon Monoxide	10,000*	9.0	---	---	8-Hour
	40,000*	35.0	---	---	1-Hour
Photochemical Oxidants	160*	0.08	---	---	1-Hour
Hydrocarbons	160*	0.24	---	---	3-Hour (6-9 a.m.)
Nitrogen Oxides	100	0.05	---	---	Annual

*Not to be exceeded more than once/year

Federal Area Classifications for Significant Deterioration Regulations

Pollutant	Class I		Class II		Class III	
	Allowable Increase ($\mu\text{g}/\text{m}^3$)	(ppm)	Allowable Increase ($\mu\text{g}/\text{m}^3$)	(ppm)	Not to Exceed ($\mu\text{g}/\text{m}^3$)	(ppm)
Particulates						
Annual	5	--	10	--	75	--
24-Hour Maximum	10	--	30	--	150	--
Sulfur Dioxide						
Annual	2	0.0007	15	0.0057	80	0.03
24-Hour Maximum	5	0.0019	100	0.038	365	0.14
3-Hour Maximum	25	0.0095	700	0.267	1300	0.50

Montana Ambient Air Quality Standard

Pollutant	Standard	Averaging Time
Suspended Particulates	75 $\mu\text{g}/\text{m}^3$	Annual
	200* $\mu\text{g}/\text{m}^3$	24-Hour
Sulfur Dioxide	0.02 ppm	Annual
	0.10 ⁺ ppm	24-Hour
	0.25 ^a ppm	1-Hour
Settled Particulates	15 T/mi ² (residential area)	3-Month
	30 T/mi ² (industrial area)	3-Month
Suspended Sulfates	4 $\mu\text{g}/\text{m}^3$	Annual
	12 ^b $\mu\text{g}/\text{m}^3$	--
Reactive Sulfur	0.25 mg SO ₃ / 100 cm ² /day	Annual
	0.50 mg SO ₃ / 100 cm ² /day	1-Month
Fluorides, Total in air (as HG)	1 ppb	24-Hour
Fluorides (Gaseous)	0.3 $\mu\text{g}/\text{cm}^2/28$ days	28-Days

^aNot to be exceeded for more than one hour in any four consecutive days.

^bNot to be exceeded more than one percent of the time.

*Not to be exceeded more than one percent of the days in a year.

⁺Not to be exceeded more than one percent of the days in a 3-month period.

APPENDIX B

STAFF

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Dennis Braun	Chemist
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Robert Raisch	Field Technician
Steve Simonds	Field Technician
Hal Robbins	Field Technician
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